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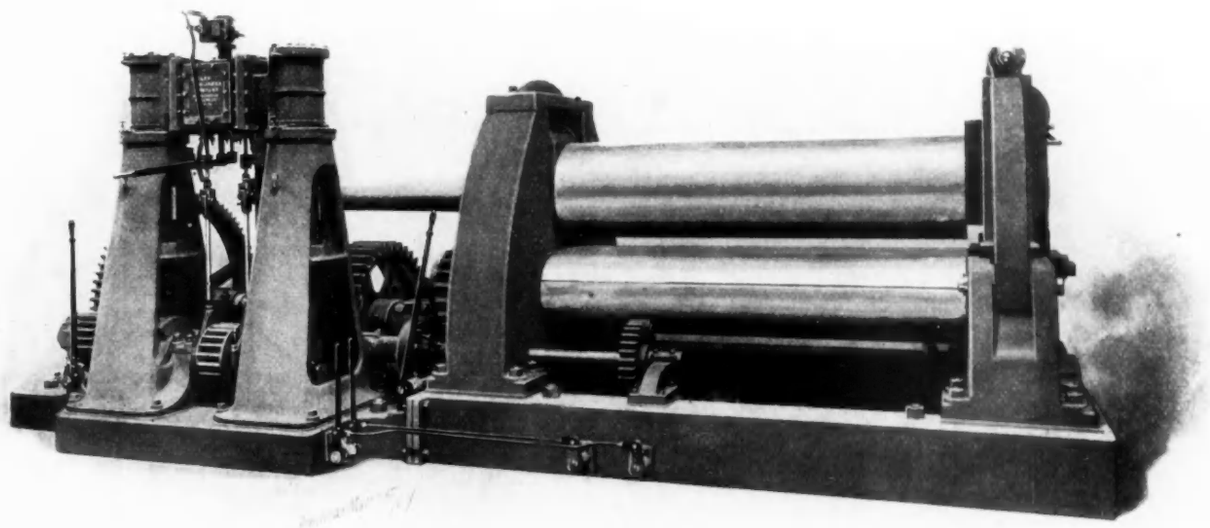
## Rolls for Bending Heavy Plate.

The half-tone shows a massive machine of new design for bending comparatively narrow widths of the heaviest plate. An idea of the size of the machine is furnished by the dimensions of the rolls, the upper roll being 25 inches in diameter, the lower rolls 20 inches and the distance between the housings 100 inches, so that a steel plate 2 inches thick and 8 feet wide can be bent. The rolls are driven, as will be seen, by duplex reversing vertical engines with cylinders 10 x12 inches. The gearing provides two



ROLLS FOR BENDING HEAVY PLATES.

different speeds for the rolls. For the slowest speed a pinion on the farther end of the engine shaft engages a large gear on the first intermediate shaft. This gears to a second shaft placed centrally below the lower rolls with a pinion gearing to pinions on each and revolving both in the same direction. For faster speeds a larger pinion on the engine shaft, between the engines, meshes into a smaller gear on the first intermediate shaft, and then through the same gearing as before. The lever at the extreme left operates clutches which engage or release either motion as desired. Raising and lowering the top roll is through a friction clutch operated by the large vertical lever near the left-hand corner of the front housing. The gear seen in front of the rolls and between the housings drives another shaft below, and clutches upon this shaft, operated by the two smaller vertical levers, determine whether both ends of the roll shall be raised or lowered at once or either end separately.

The rolls are of hammered iron, the upper roll having a long extension to the left for balancing the roll and for holding it up when plates are entered or removed. The bed of the machine is of box form. The bearing of the back housing is strongly braced to take the side motion incident to bending heavy plates. It is hinged to allow plates to be slipped out when bent to a complete circle. The pinions next the front housing are steel castings, the same material being used for many other parts about the machine. All the motions of the machine are controlled by levers convenient for the operator, and while it is necessarily of massive construction throughout for heavy work, it is readily adjusted and operated for lighter work. It is built by the Hilles & Jones Company, Wilmington, Del.

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## On Comparative Tests.

BY W. H. BOOTH.

Of all the patents submitted for test to engineers with a view to eventual exploitation of the same at a huge profit, it is not to be wondered at that some are useless, and it is to be feared that testing engineers are sometimes, to say the least, careless in putting their names to statements that are misleading. There is no man so ingenious as the so-called inventor of processes that are to revolutionize all previously known methods. When I see announcements of these revolutionary inventions my blood is no longer stirred by vain regrets of my own inability to do likewise. Many of the most wonderful of these inventions I have found to be pure swindles. Some I have assisted to strangle before sale and others

I have seen die a lingering death. I am beginning to suspect the very term of comparative test. An inventor comes along who is wholly unknown and succeeds in getting an introduction to a man who is not an engineer. He persuades this man that all engineers other than himself, the inventor, have spent their laborious days under mistaken notions of things altogether. A syndicate is got together and "comparative tests" are to be made, and now, mark what occurs. Let us suppose that a new system of steam raising is invented. We all know what can be done with water. The inventor will do twice as much as water. Now, if an ordinary boiler be taken, capable of evaporating, say, 8 pounds of water per pound of fuel, it is perfectly obvious that the new system ought to evaporate 16 pounds. I have seen reports published in which an evaporation of over 16 pounds was set down to each pound of fuel in boilers of the usual 8 to 10 pounds capacity. The figures were set down without any reference whatever to the fact that there was heat lost up the chimney, and that the theoretical maximum evaporative capacity of best Welsh coal—one of the finest fuels in the world—falls short of 15 pounds. But the genial inventor does not much desire actual figures; he wants comparisons and he provides a plant to be tested comparatively in two ways. Worked at its best such a plant as he provides cannot shown an efficiency above, let us say, 30 per cent. On the new system it is made to show 30 per cent., whereas on the old system it is so worked as only to show 15 per cent. It is an easy thing for a skillful man to do. Take a steam plant to pin one's ideas. If the boiler is just large enough for its engine a careful fireman will so work that boiler as to keep up steam, and the engine runs merrily. A little carelessness runs down the steam; open goes the throttle to keep up speed, and away down goes the steam pressure. With a small engine having a comparatively large frictional ratio, a very little difference in boiler performance makes an apparently large difference on the engine brake, though the gross indicated work may not be far different. But a comparative test of such a plant may show enormous differences in favor of a particular system, simply because of a little skillful manipulation. The testing engineer may suspect error, and must be very careful how he reports or he may find himself landed in a very awkward dilemma.

Unless, in a comparative test, the known factor shows a result such as we know can be regularly obtained, it is exceedingly dangerous to argue from comparisons. To again turn for illustration to the steam boiler, because one system shows a result of 15 per cent. and the other of 30 per cent., are we to believe that when the 15 per cent. is transformed by good plant to 60 per cent., therefore the 30 per cent. will become 120 per cent.? Yet this is the argument often deduced from comparative tests with insufficient plant, and it is an argument which an engineer may be supporting when he subscribes his name to a mere comparative report. True comparative tests must have a standard datum line. In the case where an evaporation of over 16 pounds was published, the man responsible for the figures declared his better knowledge, but avowed an ability to change the latent heat of water. To find the whole universe suddenly swept from beneath my feet by a calmly made statement of this kind was a little discomposing at the moment, but I was able to dispense with the universe for such few minutes as served me to get a little further insight of the workings of his mind. I do not know what there is about the science or art of engineering which makes the attitude of ordinarily intelligent men so different toward it as compared with their attitude toward the law, medicine, or other professions. Take to a shrewd city man some impossible invention, refuse to disclose its nature—a very good excuse to employ is that those wonderful men in the German Patent Office are for the moment lying paralyzed with astonishment at the marvelous beauty and simplicity of your invention—pour contempt on the engineering world at large, and money is poured out for a year or two in large quantity.

After a time, however, a common engineer is employed, still in the dark as to the facts of the patent. He reports guardedly and the thing goes on. Finally, perhaps, there is a full disclosure, and the emptiness of the whole thing is obvious. I have known the simple placing of an observer at the weighed coal heap to reduce results 40 per cent., and I have seen an inventor look blank when a posse of ten observers located themselves at various assigned positions.

I remember some years ago, where an inventor claimed to have reduced the cost of evaporation in a certain works by one-half. I found the claim to be true. The boiler was not doing a sixth of its proper power, and the only real change was from best Welsh coal to slack at half price, a change the boiler could very well stand under its easy conditions of work. I have seen where the public paid over a million dollars for a so-called invention, of which two minutes' inspection of the blue print enabled me to advise a man to leave it rigidly alone.

This was not due to any special perception on my part so much as to the absolute uselessness of the invention itself. Any honest attempt to find the value of this particular invention would have revealed the truth and prevented the disaster to investors which occurred.

It is almost invariably some form of comparative test which is relied upon by promoters to carry through their projects. At the moment of writing there is a good deal of discussion going on regarding the duty of a testing engineer, as to how far he ought to allow himself to be tied within a narrow range. It is to be regretted that promoters should have grown to imagine that they have a right to employ an engineer to make tests on lines laid down by non-technical men. In a recent legal case with which I was connected, which arose from the refusal of a syndicate to pay for a test and report, the judge summed up very much in favor of the testing engineers who had prepared an unfavorable report upon a process. The syndicate openly complained in court that they had paid a good fee and had not got a report that was of any service to them. The law upheld us in our contention, that we would not be bound down to carry out tests excepting as we chose.

I have observed a tendency of promoters, when they expect to get a favorable report, to state that what they want are the actual facts, yet when such facts are presented to them they begin to make excuse for not paying. In testing new processes it is often wholly unnecessary to conduct comparative tests. With plant of standard type any abnormal economy due to new systems can be found without testing the old system on the same plant.

Let us suppose liquid fuel to have been suddenly invented. Would it not be perfectly obvious that, pound for pound, it was of nearly double the power of coal without making a test with coal? Oil fuel will give far more evaporation than any known test of coal has ever shown. Young engineers should beware of the pitfalls of comparative tests. They should be particularly careful as to what they are to compare or they may find themselves merely comparing skillfulness with unskillfulness.

The personal element may entirely vitiate the value of any comparison made unless the datum line of comparison is some standard figure. It is perhaps not in reason that a patentee should be expected to show equal skill both for and against his own offspring.

London.

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## The Sims-Dudley Powder Pneumatic Gun.

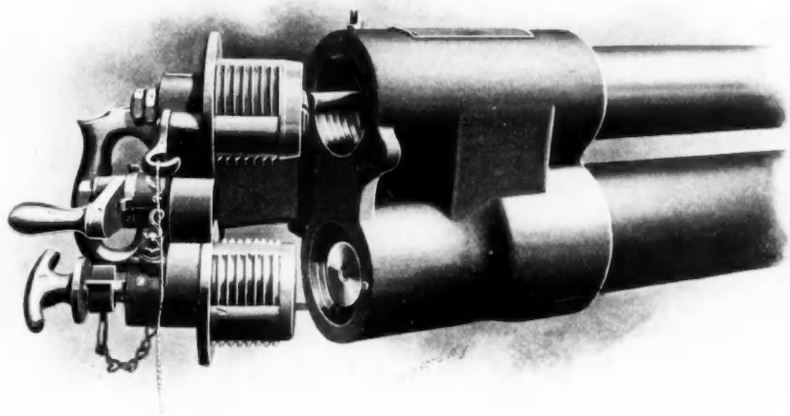
The gun shown in the half-tone may be taken to represent the most up-to-date achievement in the designing of engines of destruction. The gun is entirely beyond the experimental stage, having been used with tremendous effect by our army at Santiago, and also, in a somewhat cruder form, having a record of astonishing success in the hands of the Cuban insurgents. It is popularly called a dynamite gun, although it actually throws

a projectile charged, not with dynamite, but with Nobel's gelatine, which can be handled, stored and used with greater safety than any other nitro-glycerine explosive, and still, when properly detonated, so as to produce what is technically termed an explosion of the first order, its destructive effect is greater than that

tween the powder and the projectile and the transmitter of the force from the one to the other, the force thus acting upon the projectile with a prolonged and a gradually increasing effect, instead of with the sharpness and suddenness of the direct powder explosion.

This gun should be of peculiar interest

like to get hold of. The guns are now being built by the Garvin Machine Company, of this city. If called for they can be turned out with astonishing rapidity. No heavy machinery and no special machinery is required for their production. There is no heavy forging to wait for, no long and tedious processes of boring,



BREECH MECHANISM OF PNEUMATIC GUN.

of any other explosive known. It is impossible to throw such material by the direct fire of powder, as the concussion must inevitably explode the charge, if not directly, at least by the shock to the still more sensitive primer. In this gun, therefore, as in the pneumatic guns of the Vesuvius, compressed air is the agent used in the ejection of the projectile, but with the very important difference that this gun is at the same time its own air compressor. A small charge of smokeless powder is used, which, by the addi-

THE SIMS-DUDLEY PNEUMATIC GUN.

tion of the volume of gas produced by its combustion, compresses the air contained in the tubes of the gun, and the air acts both as a yielding cushion be-

to the machinist, as it is, except for its raw material, entirely a product of the machine shop, and comprises throughout the kind of work that good machinists

turning, rifling and the like concentrated upon a single piece. The gun is an assemblage of a number of pieces, all beautifully made to gages and with complete

interchangeability, but no piece individually requiring a long time for its production, so that any number of men may be employed at once in the production of the several details without waiting for each other or being in each other's way.

The bore of the gun here shown is 2½ inches and the length of the projectile tube is about 14 feet. This tube is of a special composition, having a tensile strength of 80,000 pounds to the square inch. The barrel is not rifled, the rotation of the projectile, shown in the foreground, being accomplished after leaving the gun by the action of the air upon the inclined wings on the spindle. The total length of the projectile is 36 inches and it weighs when loaded 11½ pounds. It carries 4 pounds of Nobel's gelatine, which is equal in destructive power to at least 80 pounds of ordinary powder, and a Merriam fuse provides for the explosion upon impact or decided retardation, as by water, or the explosion may be arranged to occur at a predetermined interval subsequently.

Below the projectile tube is the combustion and compression chamber, which is a 4½ inch steel tube 7 feet long. The firing is by an ordinary cartridge shell, also shown in the foreground, containing 7 or 8 ounces of smokeless powder. This cartridge is placed in a small central tube which projects only a short distance forward into the combustion chamber. The breech mechanisms are both thrown open by a single motion, the projectile and the cartridge are inserted at once, the breech mechanisms are closed by a single movement, and the gun is ready to fire. The firing is done by pulling a lanyard in the usual manner. Absolute certainty of operation is assured by the details and arrangement of the mechanism. There is no possibility of any discharge of the gun until both the projectile and the cartridge are in their correct positions and everything is ready to fire. In these particulars Mr. Sims, the inventor of the well-known dirigible torpedo, has contributed much to perfect the original invention of Mr. Dudley.

When the cartridge is fired the charge is driven forward in the large tube, while all the contained air is driven backward and through a large connecting passage into the projectile tube, so that practically all the air contained in both tubes is between the projectile and the hot gases. The action of the explosion upon this large body of air also insures a gradual instead of a sudden application of the pressure upon the projectile. The pressure is, however, applied so effectively that the range of this gun is from 1½ to 2 miles, with a still greater range for those of larger calibre.

The gun, as shown, weighs 1044 pounds. It can be quickly taken apart for transportation on mule back, or in difficult places all the parts can be carried by men. The parts can be assembled and the gun made ready for action in ten minutes. The cost of each discharge of this gun is but $35, while the guns using powder alone, with which it would be fair to compare it, weigh many tons and cost hundreds of dollars for each discharge. The zone of destruction caused by the explosion of the projectile is nearly 100 feet, and where its fire is directed at masses of troops the shock is so frightful that many besides the killed and the actually wounded are thrown out of the fight.

The gun may be fired at almost any desired elevation or depression, so as to be available for attacking an elevated position or in firing at an object directly below the gun. The recoil of the gun is inconsiderable, and little noise is produced, so that it is difficult to locate the gun at distances exceeding half a mile. In case of danger of capture the gun is made inoperative by unscrewing the cap from one of the tubes and carrying it off, or by taking off the breech mechanism, which can be done in two minutes.

The larger guns of this type may be used in countermining. Mounted forward on a ship they could clear a channel of all dangerous obstructions, exploding by concussion submarine mines as the ship advanced. This interesting gun is made by the Sims-Dudley Defense Company, 120 Liberty street, New York.

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## Wiener's Method of Graphic Integration.

BY LEICESTER ALLEN.

It is a matter of congratulation to many readers of the "American Machinist" that the popular, senseless prejudice against the higher mathematics, particularly the differential and integral calculus, did not cause the exclusion from its columns of Mr. Alfred E. Wiener's article printed in the issue of May 19. If any vindication of the value of higher analytical methods had been needed this article, or, rather, the graphic method of integration demonstrated and explained in it by the calculus, would have amply sufficed. It shows an intensely practical result derived from the calculus, and one which could not have been attained in any other way. To every draftsman, who is at the same time a mathematician (the number of such draftsmen has much increased of late years and is still increasing) this beautiful piece of work must have been a source of great pleasure. It is safe to say that once having commenced the perusal of Mr. Wiener's demonstration no mathematician will fail to follow it to its practical conclusion, and it is easy to follow, since each step is the logical sequence of the next previous step, and the chain of reasoning is perfect.

There are, however, some points in the practical application of the method to all sorts of diagrams, regular and irregular, or partly regular and partly irregular, which a close examination brings to light. A knowledge of these peculiarities will increase the general usefulness of the method.

The numbering of the ordinates and points used as centers for the $z$-curve can in most cases be profitably omitted, thus shortening the time needed for performing the integration. If, when the zero ordinate, which approximately divides the figure to be integrated into halves, has been located, and the ordinates on each side thereof have been drawn, and the hight of the zero ordinate has been set off on each side, as at $o'$ and $o''$, Fig. 1, the arcs for the zero centers terminating in an ordinate midway between the zero ordinate and the ones next to the zero ordinate are at once drawn, and if from the center obtained by setting off the hight of each ordinate from its foot the $z$-curve be extended as directed by Mr. Wiener, but before proceeding to the next successive ordinate, no confusion can possibly arise, and the numbers then serve no purpose in drawing the $z$-curve, and are useful only for demonstration or elucidation of the method. The continuation of the curve will always cut the ordinate last used and thus indicate infallibly the stage reached in the process, so that the draftsman may leave the work at any stage and return to it without fear of losing the place at which he stopped. Besides, in certain shapes, the centers will lie so closely to each other as to render the numbering difficult; or the centers may even coincide for a number of ordinates in succession.

In fact, as we shall see, the near, but not exact, coincidence of a number of successive centers from which extensions of the $z$-curve must be drawn is one of the difficulties that may occur in practically applying the method. This near, but not exact, coincidence of centers occurs whenever several successive decreasing ordinates pass through opposite straight parts of the outline of a diagram to be integrated, these parts lying at an angle of nearly, but not quite, 45 degrees from each other, and one of them being parallel with the axis of reference $A\ B$; also when the opposite straight parts lie at an exact angle of 45 degrees with each other, and either of them is nearly, but not quite, parallel with the axis of reference. In such a case the direction in Mr. Wiener's article that the greater the number of ordinates the closer will be the approximation to the true value, while theoretically accurate, will not hold good in practice on account of the impossibility of keeping the centers of the $z$-curve distinctly separate.

When any part of the diagram makes an angle of 45 degrees with the axis $A\ B$, as does the line $C\ D$, in Fig. 2, while the side $A\ D$ is parallel with $A\ B$, it is evi-

dent that the line $E\ F$, parallel to $A\ B$, will have the same length as $F\ G$, perpendicular to $A\ B$; hence the centers found by setting off the hights of the ordinates in the right-hand direction will exactly coincide. But in Fig. 3 the line $C'\ D''$ will give centers nearly, but not quite, coincident: they may be so near to each other that it is not practicable to keep them separate, and they may break into each other and blend to form a drunken center, thus introducing a factor of practical error. In Fig. 1 the part of the outline lying between $C$ and $D$ is

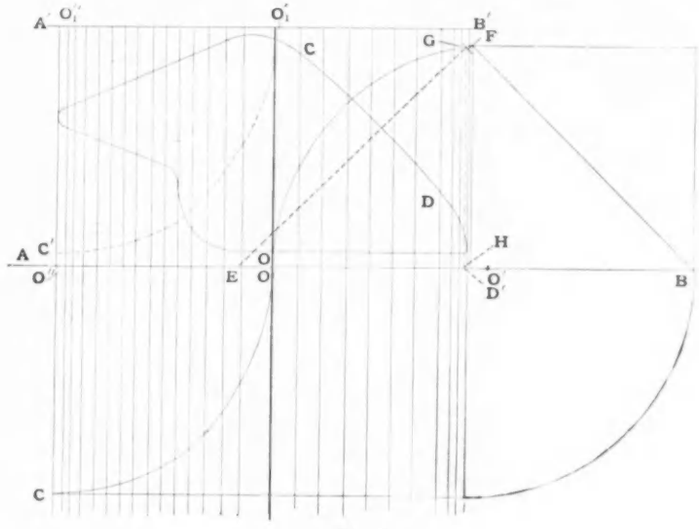



Fig. 1

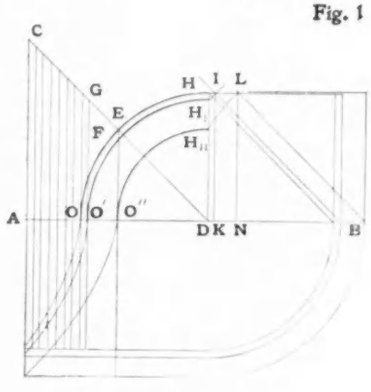



Fig. 2

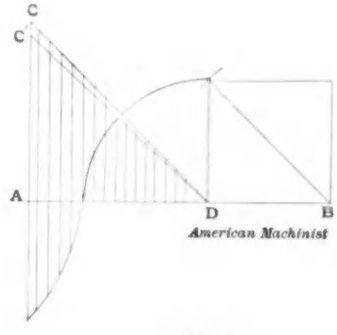



Fig. 3

OBSERVATIONS ON MR. WIENER'S METHOD OF GRAPHIC INTEGRATION.

a curve of considerable radius, and the points $C$ and $D$ are in a line that makes with the axis of reference an angle of 45 degrees. In this figure the centers to the right of the zero ordinate will some of them group closely, and if the radius of the same part of the outline be increased the grouping of the centers will be still closer.

To ascertain how much this may affect the result the area of the outline $A\ C'\ D$, Fig. 3, was sought. The side $A\ D$ being 2 inches long and the side $A\ C'$ being 1⅞ inch, the area is 1⅞ or 1.875 square inches. Wiener's method gave 1.8225 square inches; the difference is 0.0525, which is 2.8 per cent. of the correct area. Considering the confusion of centers this is a very close approximation. If instead of making the side $A\ C'$ 1⅞ inch it be made 1 15-16 inch the percentage of error may be somewhat greater, but it cannot be more than a fraction of 1-31 of a square inch, since if the centers all blend in the point $D$, the area, with reasonably accurate drawing, will be almost exactly 2 inches. This is proved in Fig. 2, wherein the foot of the zero ordinate is placed as nearly as possible at the distance of 1.4142 inches from the point $D$, or the square root of 2 inches in order to divide the area $A\ C\ D$ into exactly equal parts, so eliminating any source of error due to its misplacement. As in this case the figure is an isoceles right-angled triangle, all the centers of the $z$-curve on the right hand side of the zero ordinate will coincide at $D$. The $z$-curve on the right of the zero ordinate will therefore be drawn from a single center with the single radius $D\ H$, and will be the quadrant of a circle of the same radius. The area of the figure in a case of this kind is the square of the zero ordinate, which is equal to the distance 1.4142 inches of the foot of that ordinate from the point $D$. Hence the area is 2 square inches. The side $D\ H$, of the equivalent square, as found by Wiener's method, is not perceptibly different from the hight of the zero ordinate; hence the result is practically accurate.

To ascertain also the error resulting from displacement of the zero ordinate a Wiener equivalent was constructed with the zero axis shifted to $o'$ on the right somewhat more than 1-16 of an inch; the side $I\ K$ resulted, differing insensibly from $D\ H$; the error arising from this extent of shifting is, therefore, negligible.

Lastly, as an experiment, an ordinate $o''$ dividing $A\ D$, instead of the figure $A\ C\ D$, into halves was made, whence resulted the side $I.\ M.$, differing (notwithstanding the great error of position in the zero ordinate) by 1-32 inch from the truth, whence the area is $1.4455^2 = 2.0905$ square inches, an error of about 4½ per cent.

In fact, one of the most remarkable features of this method is the unexpected smallness of the error in the derived square resulting from errors of position in the process.

In conclusion, it may be said in confirmation of Professor Barr's statement in issue of June 9, that the sign of the negative branch of the $z$-curve is unimportant so long as the arithmetical end value of the negative $z$-ordinate is found, and that the curve above the axis of reference, $A\ B$, is just as useful in determining the desired end value as though it were drawn below the axis. But by using a second axis of reference, $A'\ B'$, Fig. 1, the second branch of the $z$-curve may be drawn as indicated and without change of sign; and, as the determination of the side of the equivalent square by the graphic method is all that is needed, by setting the length of the negative $z$-ordinate, $A\ C$ or $A'\ C'$, Fig. 1, off toward the left from $D$, and drawing from the point $E$, the line $E\ F$, making the angle $D\ E\ F = 45$ degrees, and then with $E$ as center and radius equal to the distance from $E$ to the upper extremity of the positive end $z$-ordinate, cutting off the distance, $E\ G$, the line $G\ H$, a side of the equivalent square may be let fall perpendicular to $E\ D$. Thus both the positive and negative $z$-curve branches and the equivalent square may be drawn on the rectangle inclosing the diagram. The compactness so attained is of some importance, while the approximation to accuracy remains unimpaired.

Anyone who will take the trouble to practice the method of Mr. Wiener, seeking wherein he may abbreviate it to save space and labor, will find that it grows in favor as he acquaints himself with its possibilities.

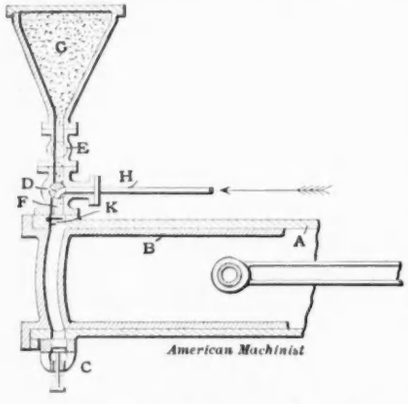
## A Substitute for Coal as Motive Power.

BY L. RUDEL.

The steady and increasing displacement of animal-power, hand-power, etc., by heat-power calls for a corresponding augmentation in the consumption of fuel, chiefly coal. While there are large deposits of coal upon our earth, enough to supply our wants for several hundred years to come, nevertheless the unequal distribution of the same leaves large parts of many continents destitute of this valuable producer of energy.

All varieties of grain are carbon hydrates and as such contain the two elements of energy, carbon and hydrogen.

Now coal is absent chiefly from tropical or semi-tropical countries, in any of which corn can be grown, and from two to four crops a year are obtainable. One pound of corn consists of about 10 parts of hydrogen, 62 parts of carbon and 28 parts of oxygen as to weight. Could not an internal combustion motor be made to burn powdered corn somewhat on the plan of the accompanying sketch, in which *A* is the cylinder, *B* the piston,




AN ENGINE FOR BURNING GRAIN.

*C* a valve operated by a kinematic device to open and close at the right moment. Cock *D* makes a half revolution, while the crank shaft makes two, connecting with the fuel feeder *G* and air pipe *H* alternately. Cock *E* regulates the supply of fuel.

Such an engine would put cereal producing countries on an independent fuel basis, their produce would always be in demand and much land which is now barren and useless could be made productive by irrigation.

Passaic, N. J.

[It is common knowledge that in years of over plentiful harvest corn is used as fuel in the Western States, and so far as the use of solid fuel in internal combustion engines is concerned, we know of at least one gas engine company which expects to adapt its engine to the use of powdered coal. The superior economy of internal combustion engines over steam engines would assist in making the scheme practicable.—ED.]

## British Foundries and Foundrymen.

Martin Fox, who is at the head of the Iron Molders' Union of North America, has been traveling in Europe, and in the "Iron Molders' Journal" gives some very interesting accounts of what he saw and learned there. In the July number he says, speaking of British foundries:

While there are some of the foundries fairly well equipped, the majority are still following after the old systems. We do not see that same specialization of the work that obtains in America. Both business and labor are pursued in a more leisurely fashion. There is not that feeling of activity and stir in the air of the foundries such as we are accustomed to. The employers do not expect or demand that the molders shall strip themselves of all superfluous clothing and hustle to get out a lot of work. Good work is demanded; the time taken is not the first consideration. As an instance of what I refer to, I recall a conversation between a foundry proprietor and myself while looking at a 20-ton casting. I asked him how long it had taken to make it. He replied that he considered the time consumed immaterial in a piece like that. He never insisted on his men turning out a piece in a specified time. He demanded good work, and did not care so much about the time taken to prepare the mold. In justification of his position he said that they had not made an imperfect casting in eighteen months. The output, of course, was principally heavy loam work.

An important characteristic of British foundries is the greater continuity of employment they offer; as a result there is not the same changing from one shop to another on the part of the molders that is so noticeable in our foundries. I was pleased to be informed also that the British proprietors gave substantial recognition to long and faithful service, for the old hands generally receive a shilling or two more per week, and, when age still further advances, shop privileges are extended to them that the younger men do not enjoy, some proprietors going so far as to pay them for time lost, and so on. In one foundry, particularly, I noticed a large number of molders who were well advanced in years. I called attention to it, and the superintendent, with a smile of pride and satisfaction, remarked: "Yes, our molders are steady men, and do not change much. There are three who have been continuously in our employ for eighteen years; the two over there, twenty years, and that old man at the other side has been with us for twenty-seven years, and he shall have a job with us as long as he wants to work and we are in the business. We pay him today two shillings per week more than any other man in the shop." Contrast this with the treatment accorded to many of the aged members in our shops, who, when time lays hands upon them and makes them less supple of limb and strong of back than they used to be, are told that they must either work for less wages or make way for a younger and stronger man who can put up a bigger day's work. That is an example of business conservatism in the British proprietor that is worthy of emulation.

Coming next to wages paid and the general comforts of life; it is true, the American workman is ahead. He gets more money for his labor, and his standard of living is higher. But then, again, he does vastly more work for it, and has fewer opportunities to enjoy himself. Speaking generally, molders' wages in Great Britain are 37 shillings (about $9) for a week of fifty-four hours. Employment, as a rule, is continuous, so that these figures compare more favorably with our own than appears on the face. The necessaries of life, excepting clothing, seem to rule a little higher than on this side of the water. Houses are rented by the week, and outside of the large cities the rents are reasonable. I had the pleasure of visiting several molders' homes, and found the rooms small, but neat and conveniently arranged, with an air of comfort and content pervading them that spoke volumes for a condition that we too hastily, I fear, designate as being much inferior to our own.

The Saturday half-holiday is an established feature of the British workman's life. It is something to look forward to during the week, and is generally taken advantage of by the whole family in the enjoyment of some simple form of recreation that the locality affords. Shortly after 1 o'clock each Saturday, if the weather be fine, great troops of working men and their families can be seen wending their way to some suburban park or neighboring town commons, where all kinds of athletic sports are indulged in by the younger element. I have often heard urged by American foundrymen, when approached upon the question of granting their help a half-holiday on Saturday, that such would but conduce to the greater injury of the working man himself, inasmuch as it would give him more time to spend in the saloon and kindred resorts. The untenability of this position is not without demonstration in our own midst, but right in England, where it is so generally observed, we find that it has quite the opposite effect. My own impression is that the saloon has a greater hold upon the man whose leisure moments are so curtailed that he seeks to press the maximum of recreation into the minimum of time; in other words, he makes haste to get drunk. The more opportunity a man has to enjoy himself in his home or with its inmates the less fear there is that he will succumb to the gilded attractions and exhilarating beverages of the saloon. No better argument can be advanced on behalf of the shorter

work-day that it will extend the home influence. The home is at the root of the nation's greatness; it is its great cornerstone, and it behooves us to labor to protect and increase its beneficent influence.

While there is much in the British working man's life to command our admiration and respect, I still honestly am of the opinion that his standard of living is somewhat below our own. That is to say, he is content with less; his food is of a plainer kind; his wants and desires are fewer; he does not dress so well. But he enjoys life nevertheless, perhaps better than we do, and it is questionable if he would change places with us.

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## Gun Making Facilities.

The Springfield armory was on a peace footing when this war came with its enormously increased demand for an output of United States magazine rifles, and it has risen to the emergency and to the limit of the capacity of its machinery with commendable speed, thanks to the abundance of skilled mechanics which this region affords. It had been making 120 rifles per day; now it is turning out 300 a day. The armory is now working on the perfected model of '98, where all the parts are interchangeable. An output of 500 a day is desired and will be reached just as soon as the necessary machines and tools can be manufactured, for they are not in stock. This means unavoidable delay. An outlay of $100,000 will be necessary to bring about the larger output.

The lesson of this situation is perfectly manifest. Congress should long ago have provided a plant here equal to producing a thousand guns a day in case of need. It could have been done without an extravagant outlay, as things are reckoned in time of war, leaving it easy at any time to speed the armory up to any desired production of magazine rifles. Now the range of its usefulness is defined, and the country must wait for its further equipment. We believe about 80,000 magazine rifles have been made, all told.

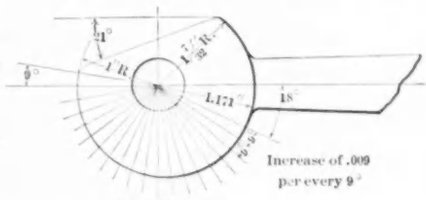
It is to be expected that the Government will be intelligently forehanded for the future. It owns here ample grounds for the full enlargement of its plant, the manufacturing has been done for years by men who have grown expert in the work, and all that is required is at hand. The only further action necessary is such an outlay in buildings and machinery as will forever insure an ample supply of rifles as the need may unhappily arise. Such an expenditure would be in the interest of future peace by giving to the world full sense of the national ability to maintain itself.—From the Springfield (Mass.) Republican.

## A Locking Cam that Will Hold.

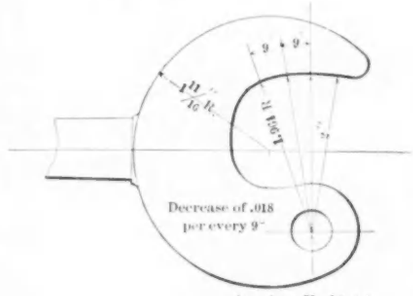
The accompanying engravings show two types of locking cams for jigs and other places which have been found to hold securely when locked, even when subjected to the vibration sometimes incident to being used on fixtures for milling machines. The layout shown is used in one of the large bicycle factories, and is stated to be entirely satisfactory.

The rule by which this cam is laid out, which has the merit of being easily remembered, is to provide an increase of .001 inch of radius for each degree of locking action in cams having a radius between 1 and 1½ inch. For radii between 1½ and 2 inches the increase of radius is .0015 inch per degree, and so on for larger sizes, the increment of radius per degree being increased .0005 inch for each addition of ½ inch to the general radius.

In making these cams they are first milled by the aid of the dividing head, the worm being turned one complete




Cam No. 1




Cam No. 2

LOCKING CAMS THAT WILL NOT SLIP.

revolution, giving 9 degrees of rotation of the spindle and cam, after which the carriage is fed in .009 inch in the case of a cam of 1 inch radius, and suitable amounts for larger ones as determined by the above rule, when another turn is given to the index crank, and so on. The steps thus made in the cam edge are then removed by filing. Of course the steps can be made smaller if desired, and for large cams it would be best to do so.

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## The Oldest Steam Engine.

The oldest engine in the world is in the possession of the Birmingham Canal Navigations, which was constructed by Boulton & Watt in the year 1777, the order being entered in the firm's books in that year as a single acting beam engine, with chains at each end of a wood beam, and having the steam cylinder 32 inches diameter with a stroke of 8 feet, and erected at the Canal Company's pumping station at Rolfe street, Smethwick. During the present year (1898) this remarkable old engine, which has been regularly at work from the time of its erection to the current year, a period of, say, 120 years, was removed to the Canal Company's station at Ocker Hill, Tipton, there to be re-erected and preserved as a relic of what can be done by good management when dealing with machinery of undoubted quality. It is worthy of note that the Birmingham Canal Navigations favored Boulton & Watt in 1777 with the order for this engine, and in 1898, or 120 years afterward, the company have intrusted the same firm, James Watt & Co., Soho, Smethwick, with the manufacture of two of their modern triple expansion vertical engines, to be erected at the Walsall pumping station, having 240 horse-power and a pumping capacity of 12,713,600 gallons per day.—The Mechanical Engineer.

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## Deficient Foreign Postage Again.

The matter of deficient postage on foreign mail matter is declared by one of our English correspondents to be about the only international difficulty now remaining between ourselves and Great Britain, and referring to our former remarks anent this matter, a London house dealing in American machinery says:

"Very rarely do we receive a mail from the other side without some postage to pay. Whether the troubles may arise in the postage department, by inexperienced office boys sending out the mails, or may be intentionally done of course we cannot say; but each mail brings one or two letters with 10 cents upward to pay. We have before us this morning mail just in 5 pence (or 10 cents American) to pay, and this is a frequent occurrence. We also find another very bad habit occurs in the American offices of letters being inclosed in wrong envelopes. We are constantly getting mail intended for other people, and naturally they get ours. This means that each of us knows what the other is doing, and you may feel perfectly assured that this is not very gratifying to either of us. Of course, we can clearly understand that with the enormous volume of correspondence that is sent out from some of the American offices errors will occur; but still it does seem remarkably strange that these underpaid postages and errors in inclosing letters should be of such constant occurrence."

Another British correspondent, when we called his attention to his own dereliction in this matter, remarked that "it is generally conceded that our American friends are the greatest sinners in this regard." Now, as a matter of fact, we have heard of no such general concession. We ourselves in this office pay deficient postage very often and refuse to accept

some mail not fully prepaid, and the fact is that this is a matter in which one usually has not a very good chance to know the extent of his own shortcomings, a good deal of mail being accepted on both sides and the deficiency paid and nothing said about it.

In our own experience we have found it impossible to be sure that boys who stick postage stamps will put the proper postage on foreign letters. Such work is done late in the day, when the boys are in a hurry to get through and not "get stuck," and they will pass over letters addressed to foreign countries without noticing them. We therefore have adopted the plan of using for foreign letters envelopes stamped in the upper right-hand corner with the word:

FOREIGN

This is just where the stamp or stamps must go, and a 2-cent stamp will not cover the word, while two 2-cent stamps and a 1-cent stamp will cover it, and these are used, no 5-cent stamps being supplied. Each stenographer has a supply of envelopes so stamped, and all foreign addresses are written upon them. This seems to work well, and our friends who are troubled by this matter might in lieu of a better plan try it. An alternative plan would be to have envelopes of special size or color for foreign mail.

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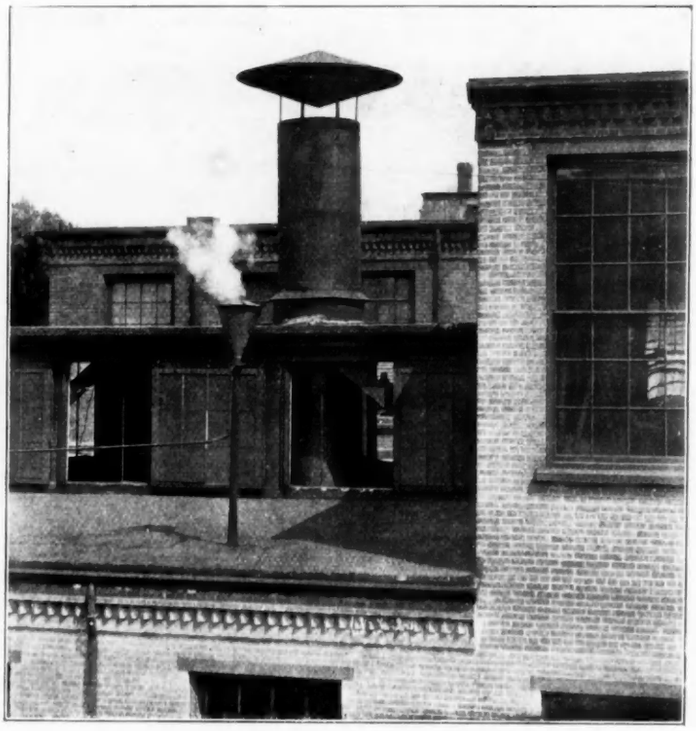
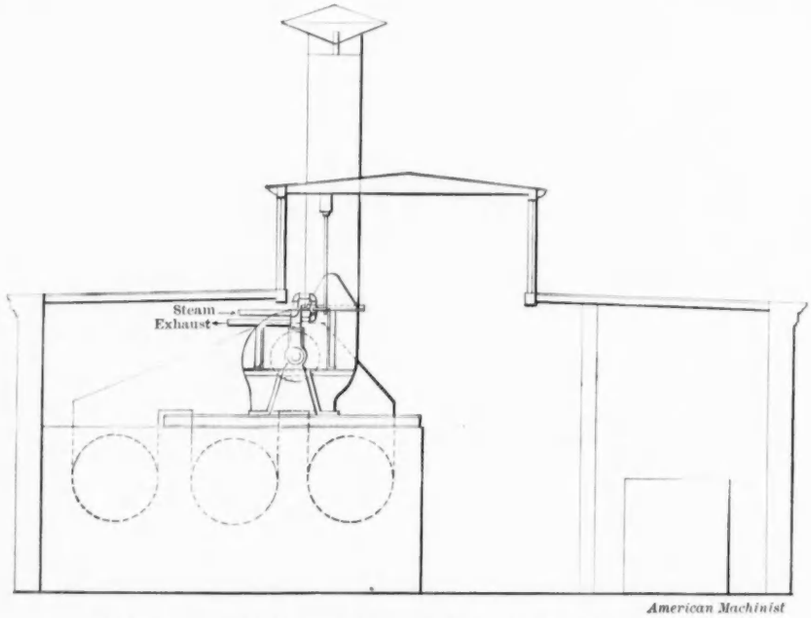
## The Fan as a Substitute for the Chimney.

Absolute confidence in the fan as an efficient means of draft production has been shown by the B. F. Sturtevant Company in the recent removal of its tall brick chimney. When the works were rearranged some time since the relocation of the boilers necessitated the abandonment of the chimney which had previously served them, and as a matter of convenience and economy a special fan was erected upon the top of the boilers and provided with a short stack extending just through the roof of the boiler house. The diminutiveness of this stack, as compared with an ordinary chimney, is apparent from the accompanying reproduction of a photograph. The boilers, which are three in number, of the horizontal return tubular type, aggregate 260 nominal horse-power. The fan contains a wheel 54 inches in diameter, the inlet connects with the uptake, and the outlet with the short vertical stack. A direct connected 5x4 double cylinder engine serves to operate the fan at such speed as is dictated by the special regulating device. This is so arranged that a very slight fall in the boiler pressure admits a considerably larger amount of steam to the cylinders, and immediately increases the fan speed and the resultant draft. The general arrangement of the entire apparatus is shown in the line engraving.



STACK USED WITH FAN DRAFT.




GENERAL ARRANGEMENT OF BOILERS WITH FAN DRAFT.

The fan creates a draft which is independent of the fire, and renders it practicable to use a cheaper grade of fuel than with natural draft. With the old chimney it was necessary to use Cumberland coal, costing $3.65 per ton of 2,000 pounds, while with the fan a mixture of Cumberland and yard screenings is used. This mixture runs as high as one of Cumberland to four of screenings, the mixture in these proportions costing $2.33 per ton. Of course the actual saving is not as great as these figures would indicate, as the evaporation is not as high with the cheaper as it is with the dearer coal. A test of the clear Cumberland and a half and half mixture was made by Professor Schwam, and has been sent to us by the Sturtevant Company. While this test is not strictly comparative, it showed an evaporation of 10.1 pounds of water evaporated per pound of the clear Cumberland and 9.28 pounds

by the mixture. On this basis the annual consumption and cost of the two kinds of coal would be

Cumberland.
1,624 tons at $3.65 = $5,929.
Mixture.
1,768 tons at $2.82½ = $4,995.
Difference $934.

From this must be deducted the cost of operating the fan, which was determined to be $183 per annum, giving a net saving of $751 per annum, which is stated to be more than enough to pay for the entire mechanical draft plant.

The boilers used with the new plant are the same as originally used with the chimney, and gave uptake temperatures of 389 and 439 degrees Fahr., respectively, in the two tests. The fan system offers excellent facilities for the use of an economizer, and with such an appliance the showing should be still more favorable.

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# Letters from Practical Men.

## Some Points About the English Hand Lathe.

Editor American Machinist:

The lathes used as a rule in the erecting rooms of English shops manufacturing textile machinery have some points of interest that may be worth noting in your columns.

Chief among the noteworthy features is the "turner" (U. S. lathesman). All jobs are alike to him, and nothing comes amiss. Be it long or short, he handles it with the deft ease of the alert craftsman, but under circumstances that I fear would prove extremely discouraging to a machinist trained in American methods. Heel tools and chasers form his stock of implements, for his lathe lacks both lead screw and carriage. Nevertheless the machine is provided with back gears and is capable of great utility, admitting the personal factor (the turner) aforesaid.

The magnitude of the tasks sometimes undertaken in these overgrown hand lathes is almost incredible when based upon our experience of shop practice on this side. For instance, I have seen a square shaft of, as near as I can recall, 8 feet long 1½ inch square being turned down for a bearing 3½ inches long at one end, and for a similar bearing 18 inches from the other end, both bearings finished with a water cut in one of these lathes.

The heel tool I send a sketch of, for it is certainly rare, if not indeed unknown, in New England, and as a specimen of misdirected skill the heel tool is to the fore. It is alike wasteful of steel and difficult to forge. The stock and handle *A B*, in Fig. 1, are of wood, the former grooved to fit shank of tool which is held down firmly by the eye bolt passing through *B*.

The rest *C* is faced with mild steel; the edges are ground square; for in taking a water cut the heel tool is hooked over the edge of the rest and obviously will copy the accuracy or otherwise of the guide.

The support *I* is to my mind just as admirable in design as some characteristics of this lathe are crude. The shaft

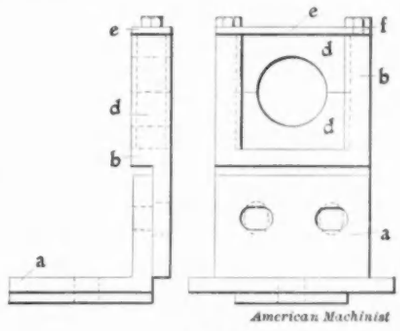


Fig. 2

CENTER REST USED ON ENGLISH LATHES.

*E* is turned eccentrically so that the handle *D* can tighten or release the bolt *G* and plate *H*. The rest can be moved in or out and again clamped in position single handed—an advantage on a hand lathe too frequently lost sight of in the design.

In Fig. 2 I have drawn the back rest; *a* is bolted down on the flat ways, *b* carries the bearing in the two pieces *d d*, which are held down by the strip *c*. One of the bolt holes in *e* is cut out on one side as at *f* to permit of readily removing work or changing the pieces *d d*. The strip *e* is also drilled in center for oil hole. It will be noted that having the retaining flanges on *b* instead of on the pieces *d d* apparently narrows the bearing surface needlessly. The bearing is often made of lignum vitæ, box or other hard wood, as well as of metal, and simplicity in the bearing is an essential feature. It is evident many of the pieces *d d* are necessary for the average range of work, but I must confess to a fondness for this type of back rest despite its disadvantages. The contact is not restricted to a narrow line, as in the average back rest, and finished work is not marred, with ordinary care. The castings require but little expense either in patterns or labor, and I have seen some doing good service innocent of contact with milling machine or planer.

R. I. CLEGG.

Providence, R. I.

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## Cooking and Mathematics.

Editor American Machinist:

It is a great thing for a fellow to do everything that he can for himself, because then he is sure to do it just as he wants it done. He should cut his own hair, do his own cooking, paint his own pictures and be his own brass band. Barbers and chefs and artists and professional musicians are all a mistake. So, also, college professors and the prestidigitateurs of the higher mathematics are as much of a mistake as the rest, because everyone should be able to do his own mathematical investigations and his own

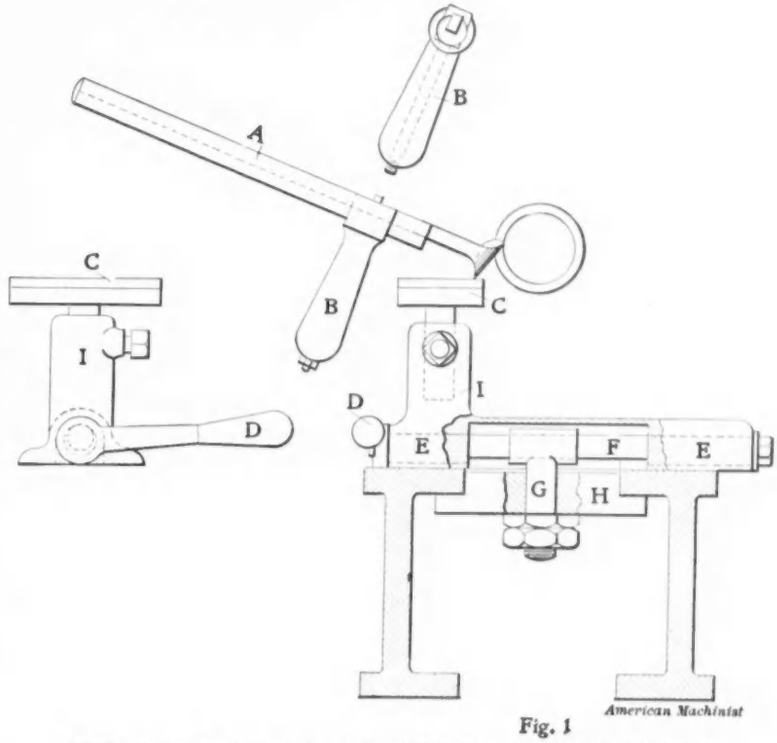


Fig. 1

SECTION OF HAND LATHE SHOWING ARRANGEMENT OF REST.

figuring clear up to the handle. At least some such impression as this is to be gathered from the present general attitude of the mechanical world. While it is absurd, of course, to expect every man to be an expert cook or an expert player of the jew's-harp, it is still expected, if not demanded, of the mechanic, as the condition of his success and the measure of his standing, that he shall be an expert mathematician. The supreme secret of modern success and progress in the concentration of effort and the specializing of occupation is here all ignored and forgotten. There is an impression quite widely prevalent that in the use of the calculus, for instance, the man who is on the wrong side of it is more or less handicapped in the mechanical race. Lots of the fellows of the shops, not only good workmen, but the inventors and designers who turn out some of our best machinery, have to sneak along with their heads down because their schooling has not carried them beyond the elements of algebra. Even men who have achieved their life's success and attained a national or a world-wide reputation as engineers, are bulldozed into expressions of regret over their deficiencies as mathematicians.

I cannot here possibly be saying a thing against the best cookery or the most exhaustive mathematics. I am disposed to magnify rather than to belittle the product in either case and the skill which produces it. The only thing to which I wish to call attention is, that while we insist upon the necessity of special training and constant practice in the one case to secure the best results, we are inconsistent in not recognizing the more imperative requirements of specialization and concentration for the still more difficult and exhaustive operations of the other. It is not to be expected, it is not possible, that a man shall know it all any more in mathematics than in cookery. We may use the results of mathematics, as we may enjoy the fine work of the cook, without being expert in the production of either. I do not propose to be any more ashamed of my lack of skill in the one direction than in the other, and I do propose to avail myself of the highest achievements in either line to the extent of my receptive and assimilative capacity, and I shall be in a better condition to use them profitably than if I had wasted my own time and strength in their preparation. I can pat the cook on the back and I can urge the professor to continually more astonishing and more satisfying achievements without self-reproach.

The cooking analogy fails us if we follow it too far, for while the cook's work is perishable the computations of the mathematician are enduring. While the cook must prepare each meal for each man, the mathematician may do each item of his work once for all. In one particular further, however, the analogy holds in full. As we may not judge a cook justly and cannot get the good of his work unless we bring a good appetite to the meal, so we must be able and ready to use the completed work of the mathematician as we have need of it. This leaves upon us still the necessity of learning at least to read the language of the mathematician. Even a child could rarely be frightened by the dishes in which the viands are served, and it is somewhat strange that the men of the shops are so easily frightened by mathematical symbols, when they are the necessary and unavoidable means of conveying the most necessary engineering material. We ought certainly to get over this. Some wiseacres are in these days telling us "how to read a drawing," a thing which mechanics have little need of being taught, but if we could be told how to read, and could learn not to be afraid to read, and not to dodge the reading of everything with a flavor of mathematics about it much would be gained.

We ought not to forget the waiter. His function is a most important one, and the success of a meal, if it cannot always be assured by him, can at any time be destroyed. So the server of mathematical and engineering data and formulas, says the compiler of an engineer's pocket book, has a most important and responsible office, and, I know well enough, one most difficult to fill with any satisfaction. When the waiter comes with his tray all our troubles should cease. His material should be all ready for our immediate use and should not be piled around for us still to laboriously select the good. So the pocket book man should as much as possible prepare and present his material for instant consumption. He must not dodge all responsibility and must necessarily set himself up as a high if not a final authority upon many points. He must not tell us A says this, B says that, C says something else, and D very different still. He is employed as a labor saver above everything else, and if instead of this he only embarrasses us with a pile of authorities and sets us to work to sift them out we owe him little. There is a noticeable difference in the various pocket books in this respect. I do not know how the best pocket book is to be made, but I think I do know that the most popular and the most used will be the one which presents the most material in the most completely cooked shape. TECUMSEH SWIFT.

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## Machinists Have Not Deteriorated.

Editor American Machinist:

Every now and then writers for technical journals tell us of the decadence of the machinist, and more or less bewail his fall from the high estate he once enjoyed. Such information must be anything but encouraging to the thousands of young men who have entered upon a term of years in which they expect to master an honorable calling, and one which they fancy will bring into use all that mind and body is capable of in the way of mechanical skill.

Not only the apprentice, but the workman, whose hands are seared and whose locks have whitened in the service, may experience a twinge of chagrin when told that, as workmen, they are not the equal of their predecessors. It is true that the status of the machinist has become changed somewhat. There are doubtless fewer "all-round" workmen and more specialists now than formerly. As to which of the two are the most valuable in the workshop must largely depend on the requirements of the place. My experience with all-round men proves to me that they rarely are found to be first-class on any special kind of work or on any particular machine tool. Life is too short for ordinary men to become expert on a half dozen different kinds of work. Even the specialist on a lathe or other machine tool, when given work that he has not been accustomed to do will not be able to gage his time on each piece until he has finished several pieces and gotten the hang of the work. All of which goes to show that even an expert in his line has something to gain by having a little practice.

An applicant for work who says he is as good on one kind of work as another may tell the truth, and in fact he may be a very useful man about the shop; but the chances are that he will not grade very high at anything, at least not until he has had some practice. I would not condemn him for turning the feed screw in the rest or tailstock of a lathe in the wrong direction at first. This only shows the importance of uniformity in feed screw threads. But when the new man grinds the cutting edges of a drill on the wrong side we have good reason to suspect that he is not an all-round man.

As to the decadence of the machine business as a trade it is not difficult to understand why some ground is found on which to support such an argument. The rapid extension of mechanical industries has created a demand for machine men beyond that which can be supplied by regular and thoroughly trained machinists. Besides it does not require such workmen to fill the positions offered in many of these industries. Their tools and appliances are generally of a special character, and suited to the special work in hand. Intelligent men, who have had no previous mechanical training, may become efficient in operating these machines in a very short time. But can such persons be regarded as machinists? I think not, no matter how long they may be engaged at such work. It may be that the machines they operate resemble very closely engine lathes or other machine tools used in the machine shop, but the work per-

formed by them is strictly routine and without variety, so that no advancement such as the machine shop affords is offered to such workmen.

With this class of persons excluded from the list of machinists, there is no reason, I think, to lament the decline of that calling. On the other hand, there doubtless never was a time when greater opportunities presented themselves to the machinist for mental culture. Besides, the refinements in modern machine construction exact from workmen a degree of skill and precision not dreamed of forty years ago. "Pretty near" will not answer in these days. As my boss once told me, "pretty near is only half."

Just where the line is to be drawn between the machine men I have described and the thoroughbred machinist I am unable to say, but of one thing I feel sure: that is, the latter has nothing to fear from his trade becoming degraded, nor should the apprentice worry over this matter, so long as he holds his place and faithfully serves out the time agreed upon; but when he gives up his position to accept one offering a little more immediate pay, perhaps, but without the prospect of advancement, he is likely to become one of those whose standing tends to make the decadence of the machinist apparent.

QUIRK.

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## Drill Sockets for Taper Shank Drills.

Editor American Machinist:

The proper holding of drills has been for years and still is a live issue with the tool makers. As evidence, see the number of drill chucks and sockets on the market, some better and some worse (mostly worse). What way of drill holding has been "kicked at" so much as the Morse taper sockets and what has there ever been brought out that could crowd them out of place?

A mechanic wanted a little special information about drill sockets, as he was making them, and he wrote to a leading concern for it, and in addition to the information (which they gave) they said that "unless one is specially fitted for such work they thought sockets could not be made to advantage these days." Now, there's a point where the manufacturers' and my experience do not agree. To begin with, commercial sockets are made of soft steel, which is not suitable for the purpose; it is too easily knocked out of shape. Next they are usually reamed with a reamer that is too small (especially the smaller sizes), thus shortening the hold of the tongue of the drill in the slot, said hold being rather short at best when made according to the Morse standard.

The sockets with tongue hold thus shortened will, under heavy strains, twist the drill tongue partly around, and if the strain is continued will let go, and the corners of the tongue hold soon get rounded off, so that the socket spoils more drills than would pay for several new sockets before it is thrown away; and these drill shanks will be fixed in good shape for spoiling other sockets. I have in the tool room a new No. 4 commercial socket that a carefully and accurately made plug gage will not go into as near to the bottom of the hole as it should by 3-16 of an inch, and it looks like a very good socket as far as appearances go. Most commercial sockets are too small by a variable amount. It is such sockets as these that damage the reputation of the Morse tapers. Carelessness in use is a bad thing that is almost universal.

Another bad thing not only for the sockets, but for the drills and other tools used in them, is encouraged by the manufacturers. It is the use of too small a socket for the tool.

Who ever saw a 9-16 drill with a No. 1 shank that was worn out without having its shank repaired, or a 2-inch drill with a No. 4 shank either?

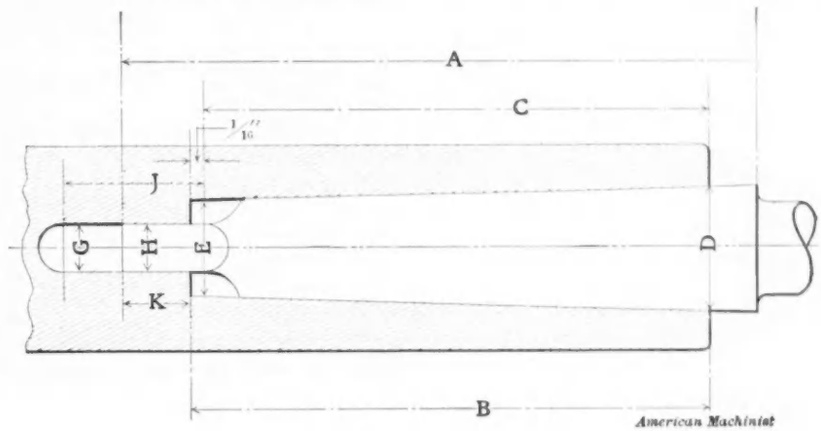
For over a year I have ordered no drill of over ½ inch diameter with No. 1 shank, and none over 1 11-16 inch with No. 4 shank, and have lately reduced the largest size for No. 2 shank, and am highly pleased with the results.

Let any tool maker look over his stock of damaged shanks, and he will find that the drills with small shanks in proportion to the size of drill are greatly in the majority, while the drills with small body in proportion to the shanks are nearly or quite absent from the lot. The drills with large shanks wear out, while the drills with small shanks get thrown into the scrap before half their useful length is worn away, even though their shanks may have been repaired a few times.

Now, if the size of shanks is properly looked after and the sockets carefully and accurately made of tool steel, the Morse tapers are the most satisfactory and convenient method of drill driving that I know of.

Sockets are often used long after they should be thrown away, when in fact it is far more expensive to use them than to throw them away.

I have for several years made shanks for tools for the drill press somewhat longer on the tongue end than the standard, and have found it a good practice. I have made good use of the Morse table that was published in the "American Machinist" of May 14, 1896, and it has eliminated the guesswork from the socket question. About a year ago I made a drawing mostly from the aforesaid article, though in somewhat different




| No. of Taper. | Length of Shank. | Hole Depth. | Plug Depth. | Socket Large Dia. | Dia. 1/16" from Bottom. | Slot Width. | Tongue Thickness. | C. to C. of Slot Drills. | Tongue Enters Slot. | Drill for Slot. | Taper Per Foot. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | G | H | J | K | | |
| 1 | 2¾ | 2 1/16 | 2⅛ | .475 | .369 | .213 | 13/64 | ⅜ | 5/16 | 3/16 | .600 |
| 2 | 3¼ | 2⅝ | 2 9/16 | .700 | .572 | .260 | ¼ | ¾ | ⅜ | 15/64 | .602 |
| 3 | 3 15/16 | 3¼ | 3 3/16 | .938 | .778 | .322 | 5/16 | ⅞ | 7/16 | 19/64 | .602 |
| 4 | 5 | 4⅛ | 4 1/16 | 1.231 | 1.026 | .478 | 15/32 | 15/16 | ½ | 7/16 | .623 |
| 5 | 6¼ | 5¼ | 5 3/16 | 1.748 | 1.475 | .635 | ⅝ | 1⅛ | ⅝ | 19/32 | .630 |
| 6 | 8¾ | 7⅜ | 7¼ | 2.494 | 2.116 | .760 | ¾ | 1⅜ | ⅞ | 11/16 | .626 |

TABLE OF DIMENSION FOR TAPER SHANK DRILL SOCKETS.

form. The only changes of consequence that I made were the length of tongue, length of slot, and distance tongue enters slot. I send blue print of drawing to show the difference. It is not a radical change and causes no trouble whatever, as these sockets and shanks will interchange with the commercial sockets and shanks.

The most vital part of socket making is to get the hole of the right size, so that the tongue will get a sufficient hold in the slot.

I have made a set of plug gages, Nos. 1 to 5 inclusive, to which I make the sockets. The gages are made of tool steel, about one and a half times the length *B;* the extra length is turned straight and knurled to give a good hold for the hand.

They are hardened all over and ground in the grinding lathe. I made them to go to the bottom of the hole, thus giving 1-16 inch at the small end for the convenient use of the micrometer in getting the correct size and taper. The bottoming of the plug gage is rather a convenience than otherwise, as the reamer never cuts clear to the bottom of the hole, for the hole is drilled with a square end drill, which is the nearest sixty-fourth size larger than the size *E* in the table, and we know when the hole is the right size by the plug just bottoming with but little tendency to stick in the hole. If the plug shows no tendency to stick, lay a narrow strip of tissue paper lengthwise in the hole, and then try the plug again, and if it sticks then the hole is not more than about 1-64th too shallow or about 1-1000 inch large.

We got our measurements of the plugs by coating the plug with a light coating of red lead, and set the micrometer so that it will go over the plug at 1-16 inch from the small end, leaving its mark in the red lead when it went over; then open the micrometer just the difference between the size of ends *D* and *E* and slide it over again as far up as it will go, being careful in both cases to hold the micrometer square with the center line of the plug; then, if the taper is right, the distance between the two marks will just equal *B*.

A set of hardened gages can be made in this manner that will be very accurate and convenient at a small outlay. Our set of five sizes cost 18½ hours' time in the tool room and about half an hour for the smith.

I will tell in another letter how we made a lot of eight sleeve sockets.

CHAS. W. WRIGHT.

▲ ▲ ▲

## Loose Pulleys and Friction Clutches.

Editor American Machinist:

A few weeks ago Mr. Tecumseh Swift gave us a lecture about step bearings and the importance of always having sufficient surface to sustain the pressure. Later he tells us about the unsatisfactory and troublesome loose pulley problem, and offers some suggestions about remedies for the trouble; but, strange to say, he never mentioned the possibility that it might be lack of bearing surface which causes their failure. All a loose pulley needs to make it a success is enough of the antidote he prescribes for step bearings.

A wonderful amount of ingenuity has been shown in inventing loose pulley oilers, just because so many loose pulleys without enough bearing on the shaft are in use, and it has been supposed that the difficulty is caused by centrifugal force throwing the oil out. I have repaired several bad loose pulleys and have spent some time on plans for oiling the same during past years, but one day I discovered that the loose pulleys on Sellers spiral geared planers were never known to give any trouble. As everyone knows, these pulleys are plain cast iron hubs reamed smooth and fitted to a polished shaft. There are no oil cups, just an ordinary oil hole and an oil groove in the bore, and they are oiled with a squirt can by the operator. There is just one peculiar thing about these pulleys; they all have hubs of a length equal to double the width of the pulley face, and that alone is the cause of their success.

Looking back over my experience I noted that in every case where a loose pulley continually gave trouble, in spite of good fitting and elaborate care in oiling, it was invariably a pulley with a hub length of but little more than the face width and sometimes less. True, many loose pulleys work well with hubs as short as the face, but it is only because the belt is not worked to its full capacity. With a single belt worked to its full capacity the hub length should never be less than 1½ times the belt width, and double thick belts at full capacity should have hubs 2½ times the belt width.

It is much the best to have the hub project equally from the pulley center, but get the hub length whether the face is central or not. When the tight pulley has a hub length of half its face width, the loose pulley may have a hub length of twice the face width, and also be central with the face, and there are very few cases where this cannot be done if thought of at the right time.

The loose pulley and shifting belt, when adapted to the work required, is the best thing ever invented for the purpose, and there is no hope that it can ever be rivaled in simplicity and durability by any possible friction clutch pulley. In fact, if the loose pulley had not been handicapped by bad designing there would not have been half so many friction clutch pulleys invented, but it is not too late to abandon most of them and substitute properly designed loose pulleys.

The friction clutch pulley nearly always has too short a hub, the result of trying to economize space on the shaft and to get the sliding sleeve to go up close to the pulley hub, and, to make it worse, the hub usually projects to one side of the rim. The wood-working shops are not to blame for refusing to adopt the friction clutch pulley as long as it is so badly designed; in fact, it is much to their credit when we consider the many wretched friction clutch pulley designs that have been accepted by machine shops.

Where a machine is not used frequently the so-called "dead pulley" is a good substitute for the loose pulley and is deserving of more consideration than it has ever received. It is a loose pulley mounted on a stationary sleeve around the driving shaft, but not in contact with it, the sleeve being supported by a hanger. To stop the machine the belt is shifted onto the loose pulley and it stops and there is, of course, no more friction and no loose pulley problem. The greatest objection to it is that in starting the machine the pulley must be put in motion before the belt can be shifted. This is usually done either by pulling on the belt or turning the pulley by hand, but a better way is to allow the pulley to have enough end play on the sleeve to bring the edge of the rim in contact with the driving pulley rim, and have a lever arranged to force it into contact to drive by friction, when the belt can be easily shifted. The friction contact lever might be connected to the belt shifter so that one movement of the hand lever would effect both functions. The mechanism should also be so arranged that the loose pulley would recede out of contact as soon as the belt was fully shifted. The dead pulley plan has merits that will stand severe criticism, and should not be condemned without a careful analysis.

The plan of making the loose pulley of smaller diameter to make the belt loose when running on it, is very good when well designed, but the loose pulley should have the end next to the tight pulley made with a conical flange, the diameter of this flange being equal to the diameter of the tight pulley, so that the belt will readily climb on to the latter. When so made it is more difficult to shift the belt onto the loose pulley than onto the tight. Of course such a pulley is more expensive, but it will save much of the frictional loss, and if made with a hub of sufficient length will give very good service on machine tool and wood shop countershafts.

The stress on the edge of the belt when starting the machine is largely compensated for by the reduced belt tension when on the loose pulley, so the durability of the belt is not much affected.

Although cheaper than any of the other plans offered I would not recommend its use for small lathes or other tools requiring frequent starting, because the belt cannot be shifted as rapidly.

BELL CRANK.

▲ ▲ ▲

## Improving the Screw-Driver.

Editor American Machinist:

There are times when a man can make a better tool than he can buy and when it pays to do so. An instance of this kind happened to me a number of years ago in connection with screw-drivers. I bought one after another, but failed to find one that fulfilled all the requirements. By the time I had used up several I began to have some definite idea of what a screw-driver should be like to do my work—which, at that time, was the building, repairing and running of automatic machinery for setting wire in different kinds of material. The motions of the machine were produced by cams, and those and many other parts of the machine required adjusting, and, being held by screws, a screw-driver was in use continually. The handles of the screw-drivers I had used were continually splitting from hard usage and from rapping different parts in adjusting. The hole in which the tang was driven would enlarge and allow the blade to drop out. Frequent replacing soon used up the handle; then the tang would be jammed into a file handle for a while, until some screw would refuse to let go with a round handle, and then a new screw-driver would be procured.

I wanted a screw-driver that would never come out of its handle except when wanted, that I could rap with on the handle end without splitting it or marring the piece rapped, that would be of convenient length to reach into the interior of the machine, and that would stand without breaking at the point; it should also fit screws from about 10-24 to ⅜ inch. I have tried the many forms of screw-drivers with interchangeable blades, but I do not like them, as the handles are too large for the small blades and too small for the large ones.

The drawing represents the result of my attempt to make a screw-driver. I have used this screw-driver for over fifteen years, it has been used also by many others, and it is just as good to-day as it ever was. I feel an affection for this old tool that has stood by me and traveled around with me in many shops, and was always to be relied upon. It has had some few wanderings from its home in my tool box, but I have been fortunate in always recovering it.

The blade was a piece of Hobson's choice steel, and was turned to the form shown. The socket was made of machine steel and forced into a piece of boxwood. The inner end of the socket was tapered and squared, being fitted to a seat in the handle and held by a wood screw, as shown in Fig. 2. To prevent the screw-driver turning in the socket two short plugs were placed in shallow holes going through the socket and into the screw-driver shank, as shown in Fig. 4. Through these plugs a small hole was tapped, in which a screw could be inserted for convenience in removing. A case hardened hexagon nut dropping over the screw-driver blade and screwing onto the end of the socket held the blade firmly in place. A short portion of the screw driver blade, just beyond the case hardened nut, was squared so that a wrench might be used upon it when required. After the socket was forced into the handle of boxwood this was turned in the lathe as much as could be, and a shallow hole bored in the end for a piece of rawhide, which was cemented in, making a surface to rap with that would not mar and that could be easily replaced. The greater portion of the handle had to be worked to shape by hand. The raised spots for the checking were laid out, marked and worked out with sharp files.

This checking looks very sharp in the drawing, but on the screw-driver it is not so, as the checks are large and shallow, making a fine gripping surface that is not disagreeable to the hands in the least.

Fig. 1 shows the screw-driver complete, Fig. 2 its construction and dimensions, Fig. 3 a section of the handle, and Fig. 4 shows the handle quarter turned from the view in Fig. 2, showing the short plugs that dog the blade in the socket; one of these is sufficient.

A new or different sized blade can be easily put in, but I have never found it necessary to do so. When I want a larger or smaller screw-driver I have a whole one just right. MACHINIST.

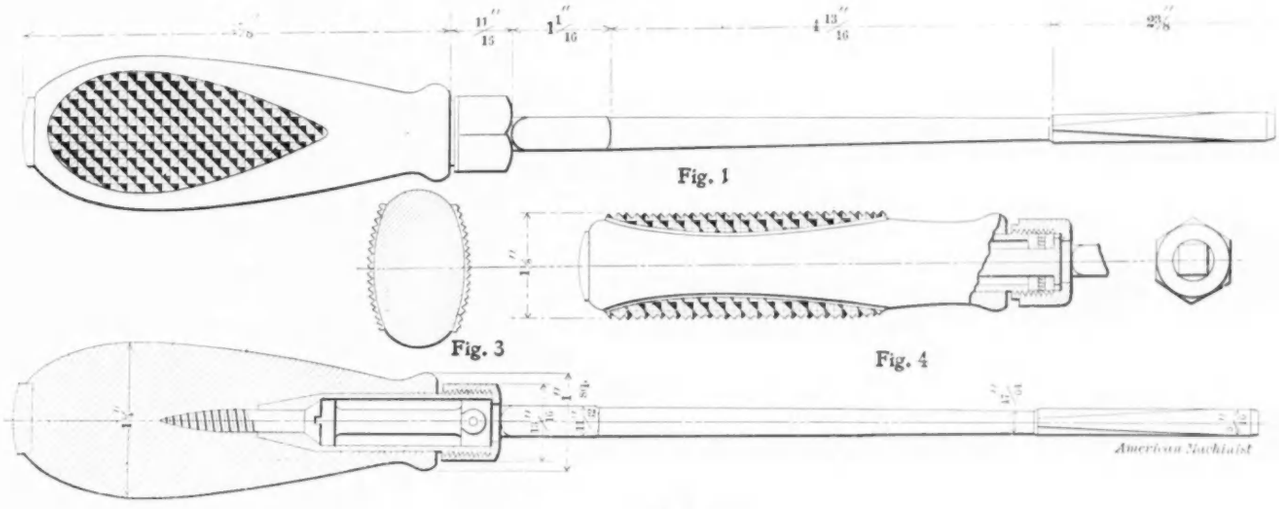



Fig. 1

Fig. 3

Fig. 4

Fig. 2

A LONG SERVICE SCREW-DRIVER.

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## Our Soldiers' Guns.

Editor American Machinist:

Can you, through your columns, inform the readers of "Machinist" why our volunteer soldiers in Cuba are not supplied with the Krag-Jorgensen rifle, the same as the regulars, instead of the Springfield, which has only half the range?

There must be machinery in the United States capable of turning out the Krag-Jorgensen. Then two months ought to be sufficient to supply a portion of the volunteers, at least, with a modern arm nearly equal to the Spanish Mauser.

Can it be that the Secretary of War's time is so taken up in turning out political generals that he has not time to arm and equip the ranks? H. W. K.

[We cannot answer the query of our correspondent. So far as we know no effort has been made to increase the production of Krag-Jorgensen rifles except by pushing the Springfield armory as rapidly as possible, which is now, we understand, turning out about 300 per day. We think contracts

should have been given to other armories at or before the opening of hostilities, and that every mechanical resource of the country should have been enlisted in the effort to place our volunteer soldiers on an equal footing with their enemies, so far as armament is concerned.—ED.]

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## Loss of Air in Air Chambers of Pumps.

Editor American Machinist:

I notice in question No. 74, issue of July 7, "T. F. H." had a difficulty with his pump which I had, which I overcame by putting an additional air chamber on the discharge pipe. Your suggestion in regard to air cocks will not help him much if he cannot stop the pump and has to lift his water from 18 to 20 feet. It has been my impression that the water absorbed the air in the air chamber after running about three or four days, and by putting on an extra air chamber it ran longer without pounding. The water came from an artesian well and was pumped out just as fast as it could come in, keeping the water level very near the bottom of the well. E. M. CHACE.

Cincinnati, Ohio.

[Our correspondent's device of increasing the air chamber capacity of course prolongs the time that the pump can run before the air has all disappeared, but does not dispose of the difficulty. The admission of a little air to the suction pipe of course impairs the suction when the water is drawn a considerable hight, as we suggested in our answer, but the practice is quite frequently adopted by leading pump makers, and there seems to be no other satisfactory device, except of course the actual injection of air into the air chamber, by a small air compressor or similar device. Running with the pet cock wide open for a minute or two should fill the air chamber even if for the time the pump ceased to draw water. This, however, might not work if the clearances in the ends of the pump cylinder were large.—ED.]

▲ ▲ ▲

## Small Gas Engine Cylinders.

HERBERT L. TOWLE.

For a normally proportioned gas engine of either of the two usual cycles, and using a given fuel, the size of the cylinder determines (1) the maximum efficiency of the engine, and (2) the proper degree of compression. The efficiency depends largely on the compression, and the latter influences also (a) the ease of ignition, (b) the proper moment for ignition, and (c) the duration of combustion. These are general propositions, true of any gas engine of the explosion types. In the small sizes the features named are affected to a degree so marked as to place these engines in a category by themselves, and to demand for them a treatment adapted to their peculiarities.

The influence of cylinder diameter on efficiency is too well known to call for extended comment. The efficiency is first limited by the feasible degree of compression, and is then still further reduced by the relatively large surface of the walls, by their thinness and by leakage. I have no complete data of the relation between diameter and efficiency, and doubt if such can be found, but such tests as I have records of indicate that for the smaller sizes, from 2 to 5 inches, the power developed is approximately in the ratio of the cube of the diameter, multiplied by the length of stroke and number of explosions per minute. In these, as will presently be seen, the degree of compression cuts but a trifling figure; but in the next larger sizes its influence is more marked, and as it rises the power of the ratio drops below the cube and approaches the square.

The most important restriction imposed by small cylinder volume is on the hight to which it is practicable to carry the compression curve. There are various reasons for this, one being the leakage of the piston rings. This factor is of course wholly uncertain in amount, depending on workmanship, the age and condition of the engine, and the grade and quantity of lubricant used. If we assume pistons in general to leak through a certain average arc of their circumference, and that for equal compression the amount of this leakage is the same per inch of arc in any cylinder, then the ratio of leakage to volume will be that of inverse squares. That is, if we halve the diameter we halve the leakage, but, the stroke being likewise halved, we get only one-eighth the former volume; so that the relative leakage per stroke is four times as great as before. Doubtless these assumptions do not represent the actual conditions, since much of the escape will be at the joints; but they help to explain why the matter of leakage becomes so serious in small engines. Especially is this the case in starting, when the rings are apt to be dry, and the slow turning of the flywheel by hand affords abundant time for the half-compressed charge to leak away. It is quite possible to make the compression space in a 3-inch cylinder so small that the engine cannot be started at all, even with carefully fitted rings and copious doses of cylinder oil.

A second reason for the low compression is of commercial origin. The gas engine is already much cheaper to run than its chief rival, the electric motor, while it is far from being either as simple or as reliable. It is expedient, therefore, to sacrifice efficiency somewhat to adapt the engine to the conditions of its service. The 90 or 100 pounds of compression used in the most modern large British engines, sending the explosion pressure, as it does, well above 300, entails a flywheel weight, a general massiveness, and efficient attendance, such as would be quite out of the question in motors destined for launches and small shops, and which are not to see a machinist more than once or twice a year.

But the ultimate reason is the small volume of the cylinder relatively to its water-cooled containing surfaces, which nullifies even the theoretical economy of high compression such as might be obtained by perfect pistons and heavy design. As is well known a large proportion of the total heat lost to the jacket goes in the instant after ignition, before the piston has had time to move out; the extreme temperature, density of the gaseous layers transmitting the heat, and relatively excessive cooling surface all favoring this circumstance. This is true of all gas engines, and in the small sizes the injurious influence of the walls and head is so greatly aggravated that any gain in initial pressure is speedily lost through failure to maintain the expansion curve. High compression in a small cylinder merely entails a heavier fly-wheel, greater difficulty in starting and added wear and tear, with no compensating increase in power, and until we can contrive to do away with the water jacket on the combustion chamber at least, it will be impossible for the small gas engine to approach even remotely to the economy of its larger counterpart.

Accepting the low compression, then, as an unavoidable necessity, we are next concerned with its effect on the subsequent operations of the cycle. The readiness with which a charge will ignite depends on four things: Its temperature, the proportions of air and gas or vapor, the thoroughness of their admixture and the degree of compression. If we assume, as we may with accuracy sufficient for the present purpose, that the condition of the mixture will be the same in any size of cylinder, it follows that the small engine is at a disadvantage in the first and last particulars, the molecules of its charge being driven into a less close approach to each other, and the temperature due to the compression itself being lower. Paradoxical as it may seem, therefore, the small engine requires actually more electricity (or other source of heat), both for continued running and especially for starting, than the large one. On the state of the mixture, on the compression and to some extent also on the temperature depends the rapidity of combustion, and when we reduce the compression we must not only lower the initial pressure of the combustion, but prolong it. If, for example, we compress the charge in a 4x5 inch cylinder to 80 pounds, we develop our heat, comparatively speaking, all at once, and lose it before expansion has fairly begun. If we compress to 40 pounds, the combustion is probably not half complete when the piston begins to move out, and it con-

tinues until well along in the stroke, giving a low but full curve whose net area is fully equal to that of the other. This prolonging of the combustion was first advanced as a working theory by Otto, the originator of the type of engine which bear his name, and though it has been the fashion with writers on the subject to decry efforts in this direction, on the ground that much of the power is developed too late to be of use, it is quite probable that for the sizes with which he worked Herr Otto was nearer right than his critics. He, to be sure, aimed at reaching the result by "stratifying" the charge, admitting first pure air, then a weak mixture and finally a rich mixture to receive the spark, and the expediency of anything but a perfectly homogeneous mixture, in the ordinary types of engines, is more than doubtful. But the principle of retarded combustion is well established.

It is, indeed, easy to overdo the thing, for the combustion is retarded very rapidly by the increasing expansion. A change in the mixture makes a great difference also. What is right for a gas engine may be wrong for gasoline, and what is right with a carburetter may be wrong without one; so that it is sometimes a rather delicate matter to adjust the mixture, compression and moment of ignition so as to get good results without having flame come out of the exhaust port. As a striking instance, the writer once cured a little 2-cycle gasoline motor, 3x4 inch stroke, of persistent back explosions by timing the ignition to occur when the piston lacked 3-32 of an inch of the dead point, instead of 1-16, as originally designed. As the charge was equivalent to about 3¼ degrees on the crank it amounted at 600 revolutions to less than 1-1000 of a second. This motor ran perfectly on gas, but when gasoline was used (it was without a carburetter) the charge was so imperfectly mixed that the combustion lasted till both ports were open, and ignited the incoming charge.

The foregoing analysis indicates several considerations of importance in connection with multi-cylinder engines. Besides their low economy, difficulty of starting and relative uncertainty of ignition, small cylinders are more expensive to build and more troublesome to care for. The advantages of the multi-cylinder arrangement are: Mechanical balance of moving parts, hence less vibration and lighter foundations; steadier regulation, lighter fly-wheels and, for launch engines, a lower center of gravity and more level shaft. The launch engine, therefore, will divide its power before the stationary engine will, and the electric light engine before that for general use. It must be a very particular exigency, however, which can justify the multiple arrangement with cyclinders less than 6 inches in diameter. If that exigency comes, the motor vehicle will probably furnish it.

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## Prospects for Trade in Cuba.

Our occasional contributor, Mr. J. de D. Tejada, of 49 East Ninety-ninth street, New York, who is an engineer born in Cuba, and much interested in the welfare of that island, says that he expects that American trade with Cuba will be very large soon after the end of the war. He expects to devote his attention to the introduction of American machinery there, and in the meantime is engaged in the translation of catalogs and trade literature generally into Spanish. In his opinion catalogs, etc., in correct technical Spanish are the only ones that will be of much service in Spanish speaking countries, and he thinks that if American manufacturers are only disposed to push for the trade they will easily secure the lion's share of it.

▲ ▲ ▲

## Technical Publications.

AN INVESTIGATION OF THE STRENGTH OF COLUMNS, LEADING TO SOME NEW FORMULAS. By Carl G Barth. 17 6x9 inch pages, with folding inset plate. Reprinted from the Journal of the A sociation of Engineering Societies.

This is an elaborate mathematical investigation in a well trodden field. It is based on the assumption of an initial eccentricity in the load, while one of its conclusions is that a low factor of safety is all that is required to make a column entirely secure.

LATHE CONSTRUCTION. 24 colored plate drawn to scale. By Paul N. Hasluck. Cassell & Co., London.

These plates are 11x16 inches and contain drawings of various lathes accurately made and colored. They include sections showing the construction fully in most cases, and afford an excellent means of becoming acquainted with British lathe construction of to-day. The drawings show the practice of a number of the leading British builders. The twenty-four plates are sold at $2.25.

THE INDICATOR HANDBOOK. PART I. THE CONSTRUCTION AND APPLICATION OF THE INDICATOR. By C. N. Pickworth. 126 5x7¼ inch pages, with 81 illustrations. D. Van Nostrand Company. Price, $1.50.

The author of this book is well known in England as the editor of the "Mechanical World," and occasionally contributes to our columns over the signature of "M. E." This book is a clear and workmanlike effort, which is especially interesting to us because of its showing several varieties of instruments which are not common, if indeed they are used at all, in this country. Two of these—the Simplex and the Wayne—adopt what has long been the reviewer's pet hobby, namely the placing of the spring outside the cylinder barrel away from the disturbing influences of the heat of the steam, with the very obvious advantage that the scales are alike whether used with steam, water or compressed air. The latter named instrument adopts the curved sliding shield for the paper and the radial pencil arm pivoted at the center of the shield suggested by Professor Sweet twenty years ago, although with a very different arrangement of piston and spring, and it also has applied to it the device for obviating inertia effects at high speed by taking the cards in sections, as suggested and tried by Professor Webb. Neither of these devices were ever applied commercially in this country, and it is interesting to see them reappear in England. Both the Simplex and the Wayne instruments are made by Elliott Brothers, who were the original makers of the Richards instrument.

A good deal of space is given to reducing mechanisms and to errors, both of the instrument and of the reducing mechanisms. In this connection the mechanisms and their errors, drawn to scale, are shown side by side, and the merits of the various methods of reduction from this point of view are clearly shown. We are glad to see the neglected modification of the swinging pendulum, in which the pendulum carries the pin and the cross-head bracket the slot, given due prominence and its superiority pointed out. It should be more widely known than it is that while the reverse and usual arrangement is very faulty, unless the lever is very long, this construction is without error, and as it is equally simple it should entirely supersede its defective mate.

The volume is to be followed by another, which as Part II. will treat of the diagram as such and its analysis—subjects which this volume does not cover. If the second volume is as satisfactory as the present one the two will fully meet the student's needs.

The book is as applicable to the needs of American as to those of English students, and in fact the leading American instruments are illustrated and their leading features are described in detail.

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We are in receipt of Part 12 of J. G. A. Meyer's 'Easy Lessons in Mechanical Drawing and Machine Design." As the publication advances its scope widens, the present number taking up the subjects the strength of beams and simple trusses, as well as the principles of the lever and of moments. The work will thus be seen to comprise a treatment of applied mechanics, which it is unnecessary to say is discussed with the fullness and clearness characteristic of all of Mr. Meyer's writings. This number completes Volume I., and includes an index and table of contents. Published by the Arnold Publishing Company, New York.

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## Inherited Talent.

Most of us consider as a matter of course that the fact that an industry has been established for many generations in any locality or country gives that country a commanding advantage over others, because of the workers in the industry being the descendants of a long line of ancestors engaged in the same kind of work, the skill, or at any rate the aptitude, for the business being supposed to have descended from father to son, and thus to give an advantage which no newcomer in the work can possess.

In machine construction this argument has often been applied to show the advantages our own country and England have over many others, and, on the contrary, in the higher branches of textile and other lines of production involving a high degree of artistic skill, the same line of argument is used to show why we cannot hope to rival many other countries for years, and even generations, to come.

We are far from denying that there is a large measure of truth in this view of the situation, but we believe nevertheless that the influence of heredity is far from being as potent as it is often believed to be. This line of argument is faulty by reason of its ignoring the "mute inglorious Miltons" which everyday observation shows exist everywhere. We all know men of superior natural ability who have accomplished nothing because surrounded in early life by an atmosphere which offered no opportunities for development on lines natural to their mental make-up, while the influences which did surround them led them into fields for which they were not adapted. It is true that genius will burst all bounds, but the work of the world is not done by geniuses, but by those whose mental aptitude, while pronounced, is not accompanied by sufficient will power to entirely burst the bonds of circumstances.

Our readers will recall a description of the methods employed in a Danish bicycle factory given in one of Professor Sweet's letters last year. These methods were native to the soil and accomplished excellent results. The proprietor had, however, on the occasion of Professor Sweet's visit, just concluded a contract for a lot of high grade, up-to-date American tools for doing the work, and obviously, in the professor's estimation, with poor prospects of success, owing to the difficulty of changing people's habits and introducing methods which are foreign to those which they have always followed. It has recently come to our knowledge, however, that the results obtained in this case have been so successful that a second order has been placed for additional tools aggregating about half the original purchase, all of which we think goes far to show that inherited traditions and habits have less to do with such matters than is commonly supposed.

It may of course be true that ingrained aptitude for a line of work may be absent from men of a given nationality, as for instance the mechanical faculty appears to be absent from Spanish speaking people, both in Spain and in Spanish America, but it is by no means safe to conclude that because such aptitude does not show on the surface it is therefore entirely absent. Not many years ago no one would have supposed the German people to be natural mechanics, but to-day no one doubts it, while the astonishing development of the Japanese in directions for which their entire past history gives no indication of a possession of the necessary qualifications, is a matter of world wide comment.

So far as a mere change of methods is concerned it seems to us to be rather a matter of intelligence than of inheritance, and this we believe to be the explanation of the success of the Danish bicycle factory with new appliances. No one who knows the Danes can doubt their possession of high mechanical skill and a high degree of intelligence, and with these combined a change of method is easy. It is a common remark that mechanics who have been "raised" in old-fashioned shops make the best workmen when given the most advanced appliances, and there seems to be no reason why the same may not be true if the workman is a foreigner and the shop across the sea.

In the beginning of the transformation it is of course a mere matter of adaptation and of copying, but such things grow by what they feed on, and we are likely to find ourselves sadly mistaken if we assume that because a people have shown slight progress in devising new methods in the past they must therefore be expected to show similarly slow progress in the future.

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## The Armament of the American Navy.

It is well known among those familiar with the subject that one of the characteristic features of the vessels of the American navy lies in the great weight of guns which they carry. This is but a continuation on our part of an old policy. It has always been considered by our naval authorities that a commanding factor in our naval success during the war of 1812 was the superior weight of guns in our ships. Our readers will recall an article in our issue of June 17, 1897, giving some leading particulars of the New York, Iowa and Puritan, in which was quoted from the "Fortnightly Review" some figures by an English naval authority comparing the Iowa with a much heavier English ship, and showing the power of the Iowa to be much superior in weight of metal thrown.

The comparison was also extended to our cruisers, and the conclusions drawn were eminently favorable to our methods. The "New York Herald" of July 14 reports an interview with Admiral Lord Charles Beresford, in which the significant statement is made, "that our [the English] ships are underarmed is not only my opinion, but that of many other naval officers."

We do not know to how great an extent these opinions are the result of the recent engagements at Manila Bay and at Santiago, but it is certain that until recently the general opinion in England, or at any rate the opinion of those in authority in the English navy, has been the reverse of those cited. It has been a source of frequent criticism there that the apparent strength of our ships is elusive because of their alleged over armament. Our naval constructors, in fact, have been considered almost reckless in putting a weight of guns on our

ships which it was declared they were unable to carry in action, and which was sure to destroy them whether it did the enemy or not.

Whatever may be thought of the engagements at Manila Bay and Santiago as regards the merits of the fleets engaged, there can be no doubt that they have demonstrated the wisdom of our policy of heavy gunning, and the lesson is likely to be heeded by the naval constructors of all nations.

To our mind the comparatively light armament of the British navy is but another illustration of a British characteristic. The Englishman seems to be constitutionally afraid to exact a maximum duty from a given amount of material. As is well known, his engineering structures of all kinds are, from our standpoint, ponderously heavy, being in fact built as though intended to last forever—as, in fact, some of them bid fair to do. We are by no means disposed to claim that our general practice in this respect is necessarily superior. It is at least an open question if many of our machine tools, our engines, and especially our boilers, would not be decidedly improved if in this respect they were to be made more on English lines. When it comes to a battleship, however, it is not the object of its existence to last forever, but to do its maximum duty in its supreme hour of trial. In view of the results which are still fresh in our readers' minds, there can be no room for doubt that in this field our practice has been sound.

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## Questions and Answers.

**Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.**

(81) J. L., Brooklyn, N. Y., writes: I have gotten into a little discussion about whether vacuum has power. I say that it has power, because to create a vacuum it requires power through the agency of heat, and after the vacuum is formed we have stored up energy. Please state whether this is right or not? A.—We do not consider that a vacuum has power. A vacuum is literally nothing, and nothing cannot have or contain power or anything else. The work done in forming a vacuum is done in forcing air out of a certain space into the general atmosphere surrounding the surface of the earth. This air is forced out against the resistance of atmospheric pressure, which atmospheric pressure is caused by the weight of the air, and this air, when it is again admitted to the space in which the vacuum has been formed, will do work, and it is clear, therefore, that the work or energy is not stored in the vacuum, but in the air surrounding the vacuum.

(82) L. G. A., West Point, Ga., asks if a No 6 B & S gage copper wire is large enough to supply current for 300 16 candle-power lamps at 110 volts, and for a formula giving the capacity of electrical conductors. A.—No; the current is beyond the capacity of the wire, to say nothing of reasonable drop in pressure. The following formula gives directly the size of wire for a given number of lamps:

$$A = \frac{2150\ W\ L\ N}{a\ E^2}$$

in which
$A$ = section of wire in circular mills;
$W$ = watt rating of lamps;
$L$ = distance to center of distribution in feet;
$N$ = number of lamps;
$a$ = percentage of drop;
$E$ = voltage.

You do not give the value of $L$, but assuming it at 200 feet, taking $a$ at 5 per cent. and the wattage at 3½ per candle-power the result is as follow:

$$A = \frac{2150 \times 56 \times 200 \times 300}{5 \times 12{,}100} = 119{,}500$$

which calls for wire of No. 0000 B & S gage. The percentage of drop allowed is proper for lamps which are to be burned promiscuously. In case the lamps are to be all on or all off, the percentage might be increased to 10 with marked economy of wire.

(83) Q. E. D., Pittsburg, Pa., asks: (1) What feature of a dynamo constitutes it a constant potential machine? A.—Shunt winding. (2) What a constant current machine? A.—Series winding. (3) What is the result of running a dynamo too fast? A.—Increase of voltage and, if the resistance is unchanged, of current. (4) What of running it too slowly? A.—Reduced voltage and, against the same resistance, reduced current. (5) What is the result of operating a motor at too high a voltage? A.—Increased speed. (6) What of operating it at too low a voltage? A.—Reduced speed. (7) Can a current be maintained at a very high voltage and of but a fraction of an ampere of volume? A.—Certainly. (8) What voltage would be dangerous to life on such a current of, say, 1-10th ampere? A.—Arc circuits of about 10 amperes have been known to kill at 700 volts, while 1,000 volts have been taken without fatal results. A good deal depends on the individual, on the condition of the contact surfaces as regards moisture and on the manner of taking the current. The breaking of a circuit through the body is much more dangerous than merely connecting across the terminals. What the danger point of pressure for such a small current as you name would be we do not know. (9) On a complete metallic circuit furnishing power to run various motors and lights will a person receive a shock by touching one wire, assuming the circuit to be perfectly insulated at all other points? A.—No. (10) Where should I place a circuit breaker to protect a generator? A.—Near the generator. (11) Where on a branch circuit to protect several motors? A.—They are usually placed near the division point. (12) A weight of 1 pound falling 10 feet = 10 foot pounds = 120 inch pounds. This is said to equal a weight of 120 pounds falling 1 inch; or, to follow the same reasoning, 120,000 pounds falling 1-1000th of an inch. A beam amply strong to resist the shock of 1 pound falling 120 inches would at once break under the heavier weight falling the shorter distance. Please point out the fault in the reasoning? A.—You confound energy with force. It is not energy which breaks the beam, but the force due to the destruction of the energy. If the beam is springy the force due to stopping the small body may be much less than the simple weight of the large body, and a beam which would sustain the former would break under the latter.

## Employment at Springfield Armory.

Having received some inquiry about the matter, we have ascertained some facts regarding wages and employment at the Springfield (Mass.) armory.

They are paying tool-makers about from $2.50 to $3.50 per day of eight hours. Most of these men work overtime at present, so that one who receives $2.50 nominally gets by overwork $3.17 per day. There are two gangs at work, a day and a night gang.

The outlook for more work in Springfield is poor; particularly so if a man has no friend in the shops to look out for him and notify him of a vacancy or opening. There are so many machinists in that section that a man going there as a stranger would ordinarily have great difficulty in finding work at present. The Overman Wheel Company is expected to shut down, and that will throw a large number of men out of work. They are nearby in Chicopee, and ready to take any chance that offers, many of them living in Springfield.

At present the armory does not seem to be in need of any men, as a number of them are seen waiting outside the office at all hours of the day. A man who could go there and camp down and stay would probably find work in time. There is very little advertising, as most of the men can be found by inquiries among men already employed.

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## American Association for the Advancement of Science.

The fiftieth anniversary meeting of the above-named society will take place at Boston, August 22 to 27. Prof. J. J. Flather, secretary of Section D (Mechanical Science and Engineering), sends us a partial list of papers to be read before that section, as follows:

High Speed Influence Machines. By Charles W. Warner, Cambridge, Mass.

The Development of the Topographic Work of United States Geological Survey and Its Application to the Solution of Economic and Engineering Problems. By Charles D. Walcott, Washington, D. C.

Instruments and Methods of Hydrographic Measurements by the United States Geological Survey. By F. H. Newell, Washington, D C.

Proposed Methods of Determining the Frequency of Alternating Currents. By Carl Kinsley, Falls Church, Va.

On the Efficiency of Refrigerating Plants. By Prof. Storm Bull, Madison, Wis.

Some Experiments on a New Form of Impact Testing Machine. By Prof. W. K. Hatt, Lafayette, Ind.

On a Dynamometer Car and Its Equipment. By Prof. L. P. Breckenridge, Champaign, Ill.

An Integrating Dynamometer for

Measuring the Work Done in Drawing a Train. By Prof. Thomas Gray, Terre Haute, Ind.

A Combined Absorption and Transmission Dynamometer for Laboratory Purposes. By Prof. J. J. Flather, Lafayette, Ind.

On the Measurement of Train Resistance by Dynamometer. By Prof F. C. Wagner, Terre Haute, Ind.

On the Use of Platinum Resistance as a Pyrometer in Boiler Tests. By Prof F. C. Wagner, Terre Haute, Ind.

A Comparison of the Efficiency of the Rheostat and the Series-Parallel Controller for Electric Cars. By Prof. Thomas Gray, Terre Haute, Ind.

Note on a Curious Example of Elastic Eolotropy in Steel. By Prof. Thomas Gray, Terre Haute, Ind.

Other papers will be presented, the subjects of which will be announced later.

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## Obituary.

William Boofman, superintendent of the American Sheet Iron Works, Phillipsburg, N. J., died at his home, Easton, Pa., on July 7, fifty-seven years old.

John G. Knabb, an old railroad engineer, died at Reading, Pa., July 16, ninety years old. He worked on the construction of the Philadelphia and Reading Railroad sixty years ago, was one of its first engineers and continued to run trains for forty years. He was never married.

James Patterson, who died in Philadelphia, July 18, was a veteran engineer, with a record rarely attained. He was on the Mississippi, the flagship of Commodore Perry's expedition, which in 1853 opened Japan to the world, and he is said to have been the first man to run a locomotive in Asia. He was acting chief engineer of the Young Rover in both attacks on Fort Fisher in the civil war, and also served in the Battle of Mobile Bay. After the war he was a chief engineer of the Pacific Mail Line, and was on the Montana when lost on the Lower California coast in 1875. He was one of the first volunteers of the Jeannette relief expedition.

James Rodie, a boilermaker of wide reputation, died at his home, Kingston, N. Y., July 21, sixty-six years old. He was a native of Glasgow, Scotland, and was employed at the West Point Foundry, Cold Spring, N. Y., when the fame of that concern was second to none in the country. The boilers for the United States frigate Merrimac, afterward the Confederate ram Tennessee, were built at the West Point Foundry, and Rodie placed them in position in the Charlestown Navy Yard, where the ship was built. He was later connected with the firm of Theodore Smith & Brother, Jersey City, and while there he built twenty-one boilers and hundreds of buckets for the Panama Canal dredges.

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## Personal.

With the end of the present month Mr. John J. Grant's connection with the Cleveland Machine Screw Company terminates, and he will go into the business of building machine tools, probably in Cleveland.

Mr. H. P. G. Norstrand, for four years chief draftsman of the Aultman & Taylor Machine Company, of Mansfield, Ohio, has accepted the position of superintendent of the Pennsylvania Boiler Works, Erie, Pa.

Mr. John E. Franzen, who was at first a tool maker and was afterward advanced from one position to another with the Sprague Electric people, has recently been appointed superintendent of their New York factory at 527 West Thirty-fourth street.

Benjamin W. Grist, who for twelve years has been connected with Pennsylvania Iron Works Company, of Philadelphia, first as general superintendent and later as vice-president and general manager, has resigned to become the general manager of the Siemens & Halske Electric Company of America, and will be located at Chicago.

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## Inquiries for Machinery.

Those who make, or may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

60. From Australia, for machinery for making and printing sugar bags of jute or calico and varying in size to hold from 6 to 200 pounds.

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Bridge companies are reporting an unusual number of contracts for small bridges, which means that they are beginning to share in the prosperity of the agricultural sections. The Middle and Middle Western States, which have not profited much directly by the advance in wheat, have still been making money, and township and county bridge projects are now ripening. The same amount of business thus distributed tells a very different story than if represented by a single contract for one of the big corporations.

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Professors Anderson and Nicholson, of McGill University, Montreal, have recently conducted some interesting experiments in the solidification of metals by pressure. Filings or turnings of brass, iron, copper, tin and other metals were pressed into solid bars apparently differing little from bar metal produced by the usual processes. The materials are enclosed in a jacket of steel somewhat conical, and pressure is applied and maintained ten minutes. Pressures have been used up to 78,000 pounds to the square inch.

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Two of the largest open-hearth steel boiler plates ever made in this country were rolled recently at the South Chicago mill of the Illinois Steel Company. Each plate was for the shell surrounding the fire box of a consolidation locomotive. The plates were rolled from ingots having a cross section 18 by 40 inches. The dimensions of the sheets before shearing were 128 by 360 inches for one and 130 by 375 inches for the other. They were sheared to 124 inches wide and 220 inches long on one edge and 237 inches on the other. The actual gage of one of the sheets was .577, .577, .577 and .574 at the four corners, and .640 and .623 at the middle of the ends.

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# Commercial Review.

NEW YORK, SATURDAY EVENING, July 23.

DYNAMOS AND MOTORS.

"People are getting their nerve back again; they have found out that the Spaniards are not going to bombard them after all." So speaks a representative of one of the largest electrical corporations, and so does it appear from the statements generally heard in the market. In short, the tone of business in electrical machinery is as surprising as it is gratifying. Instead of a tapering off of trade from June to July the latter month seems to have experienced an improvement as compared with the former. Conditions will shortly be much more favorable than they are now, for at present many people are out of town and the hight of the lighting season will not be reached for a month or two yet. If business is already manifesting so strong a tone, what will it not do later on? Sellers look forward to the fall with a great deal of confidence.

Here is a slight indication of what is going on at the shops: The Card Electric Company has been for six or seven weeks running days and nights and Sundays. It is six or seven weeks behind hand with orders. The Crocker-Wheeler factory, Ampere, N. J., continues on double turn. The Bullock Electric Company, Cincinnati, Ohio, is running with two shifts in some departments. The C & C Electric Company continues to do so in certain lines.

The Walker Company reports an order from its Paris agents for 500 electric street car equipments, including 1,000 motors, 1,000 controllers, 500 trolleys, etc., amounting in value to more than $500,000. The machinery is not all destined for Paris. Domestic sales, in ad-

dition to the twenty 500 horse-power alternators ordered by the Union Carbide Company, have included three 400 kilowatt dynamos for the New York Light, Heat & Power Company. The Walker Company is adding to its works a new building, in which it will install some tools.

We learn that the motor works controlled by the Sprague Electric Company, which sells the Lundell fan and power motors, are congested with orders, and are running on night shift, being now 350 machines behindhand. The Government cleaned out the supply available. Its purchases, which still continue, have included fan motors, motors for ammunition hoists, for pumping and for many other purposes. Some are on board the Gloucester, which so signally distinguished itself in the Santiago fight. Exports are better than ever before, and large orders from abroad are becoming so much a matter of course that we are told it is hardly feasible to mention them individually. One of the best foreign orders ever received has lately come in. In general the business of July is better than June and the outlook is very bright.

### DOMESTIC SALES AND INSTALLATIONS.

Among the chief street railway contracts recently taken by the General Electric Company is one to furnish fifty motor equipments to the Consolidated Traction Company of New Jersey. The business of the General Electric Company is stated to be as good now as ever in its history.

A notable example of the modern system of furnishing buildings with power electrically distributed to tenants will be found in the Manufacturers' Building, Providence, R. I., which has accommodations for upward of sixty concerns, being especially adapted to those producing jewelry, specialties, etc. For this building has lately been purchased a 250 kilowatt 500 volt Westinghouse Electric & Manufacturing Company's engine type generator, to be driven by an Armington & Sims Corliss engine. The generator will supply power to motors in the various departments of the building. The engineering features of the establishment are under the direction of Lewis & Claflin, consulting engineers.

The development of electrolytic processes for the production of refined copper has proceeded rapidly during the past three years, and at the present time a large proportion of all the refined copper is thus produced. The Westinghouse Electric & Manufacturing Company has installed a very large amount of apparatus for this class of service. One of the principal installations is at the refinery of the Anaconda Copper Company, Anaconda, Mon., where ten generators of 270 to 300 kilowatts' capacity have been put in. Another very large one is that of the Boston & Montana Consolidated Copper & Silver Mining Company, Great Falls, Mon., where two 810 kilowatt Westinghouse engine type generators are in service. The latest comer in this field is the Raritan Copper Works, of Perth Amboy, N. J., which are to erect about the largest copper refinery in the East. They have contracted with the Westinghouse Electric & Manufacturing Company for three 600 kilowatt 150 volt engine type generators, 150 revolutions per minute, with a nine section switchboard for electrolytic service and the operation of two 75 kilowatt 220 volt engine type generators, which will be used for lighting and power service. The installation is claimed to be the most complete of its kind in the world.

Recent electrical enterprises in this locality include a number of lighting and power equipments for dry goods establishments. For a building of H. O'Neill & Co., dry goods merchants of this city, three Crocker-Wheeler generators, aggregating 300 kilowatts, have been purchased. An electric power plant of the same make is to be installed in the silk mill of Johnson-Cowden & Co., at Paterson, N. J. Osterberg & Sutton are engineers for the machinery equipment of a local dry goods factory owned by Wolff, Einstein & Co., in which a 50-horse-power Ames engine and a Walker dynamo are being installed: the plant probably to be doubled eventually. The same engineering firm is fitting up a factory at Patchogue, L. I., with what are said to be the first lace curtain looms ever run by motors. A Westinghouse generator and Crocker-Wheeler motors are put in this plant. A large building, to be used for factory purposes of some sort, is to be erected on Spring and Hudson streets, and it is probable that Osterberg & Sutton, as engineers for it, will ere long be in the market for an electrical plant, estimated roughly at 700 horse-power. This building, owned by Trinity Corporation, will adjoin the Garvin Machine Company's Works, and will be on the site of one destroyed by fire some time ago.

### THE EXPORT FIELD.

Blackall & Baldwin, 39 Cortlandt street, New York, will represent the municipal council of Shanghai, China, in the purchase of an incandescent lighting plant, including two 100-kilowatt alternaters, engines, boilers and other apparatus. The firm are selling agents of the Crocker-Wheeler Electric Company, but tenders have been asked of all leading manufacturers of alternating apparatus. The Fort Wayne Electric Corporation has lately shipped a forty lamp arc lighting machine to be added to a plant of their machinery at Murilla, Mexico. Among the best foreign inquiries noted at their local offices of late have been Mexican ones. The C & C Electric Company has taken an order for 125 horse-power of direct-connected motors for a large shipbuilding concern in England.

### MISCELLANEOUS.

A company of German capitalists controlling steel plants in Germany, Austria and Wales will, it is said, erect one near Pullman, Ill., which will cover 20 acres of ground, and be one of the largest in America.

The awards of contracts to furnish machinery for the New York Navy Yard, based upon bids opened June 28, have been made as follows in part: To Manning, Maxwell & Moore, 72-inch screw cutting lathe, $4,445; 24-inch lathe, $745; 16-inch lathe, $408; 50-inch vertical drilling machine, $750; two-spindle centering machine, $333; two vertical sensitive drills, $130; 14-inch lathe, $270; also wood-working and other machinery. To Fifield Tool Company, 37-inch screw cutting lathe, $2,140. To the Pratt & Whitney Company, turret head power bolt cutter, $220; 90-inch spur and worm gear cutting machine, $3,400. To William Sellers & Co., self-acting planing machine, $2,050; another, $900. To Bement, Miles & Co., 16-inch double shaping machine, $1,825; universal radial drilling machine. To Fitchburg Machine Works, 32-inch vertical drilling machine, $320; 24-inch vertical drilling machine, $275. To U. Baird Machinery Company, keyway cutting machine, $300; vertical milling machine, $645; 21-inch swing drill, $85. We understand that the Putnam Machine Works received orders for two good sized machines. The Chambersburg Engineering Company took the contracts for an automatic cut-off horizontal engine at $1,300 and an 800 pound single standard steam hammer at $700. A locomotive steam crane is to be built by the Industrial Works, Bay City, Mich. The electrical machinery was divided between the Westinghouse and General Electric companies. The New Jersey Foundry & Machine Company secured the contracts for five of the wood-working machines.

The chief of the Bureau of Statistics of the Treasury Department sends us a non-official statement of Chinese foreign trade for 1897, based upon Chinese statistics. It shows that since 1890, while total Chinese imports have increased 65 per cent., those from the United States have increased nearly 240 per cent. The values, however, are given in Haikwan taels, which have depreciated more than one-half in the meantime. Among the chief articles sent from this country is mentioned machinery, the value of which rose from 2,084,441 taels in 1896 to 2,716,737 taels in 1897. The tael is worth about 70 cents.

The following is taken from a report of Louis Stern, an American commercial agent at Bamberg, Bavaria: "Of all the

products of American industry there are none, for the time being, of greater interest for the export trade than those of our manufacturers of machinery. It is certain that the United States has outclassed in this particular branch all the other industrial nations, and this fact is acknowledged to-day even by persons who, upon the whole, do not evince much friendship for our country. The city of Bamberg is not an important place for industrial enterprises. By far the greater part of products exported from here is not made in this town, but in the neighborhood. Notwithstanding this, American machinery has been very successfully introduced at Bamberg, and every week the local newspapers contain advertisements touching the sale of American agricultural and tool-making machines. Only a few weeks ago a shipment of American machines to manufacture metal capsules for bottles (manufacturer, Bliss Company, Brooklyn) arrived here, and I am glad to be able to state that these machines were not only entirely satisfactory to the purchasers, but exceeded their expectations. This is worthy of note, considering that only a short time ago capsules made in Germany were exported to the United States. American machinery for the manufacture of shoes can be found in any German establishment of importance, and the United States electric machinery (Walker Company, Cleveland) used in the electric street railway of Bamberg is giving entire satisfaction. This is saying a good deal, considering that one of the largest works for electric engineering in Germany (Schuckert, at Nuremberg) is within close proximity. If our manufacturers, especially those of specialties, would take the good advice given good results would be bound to follow. Circulars printed in English are of no use in this country. Those who follow the example of two American gentlemen of my acquaintance who had a patent for an ingenious cigarette making machine, and did not mind the trouble and expense of coming to Europe last year and showing their apparatus at work, may be sure of success. The figures of the export of German machinery for the first four months of this year again show that manufacturers here are straining every nerve to improve their foreign trade. The export of Germany machinery to Russia—Germany's largest buyer—has, after a short depression, again risen. German's exports of locomotives last year were chiefly to Belgium, Denmark, Austria-Hungary, Roumania and Switzerland; while there was a decrease in this line to Russia, the Transvaal and the Dutch West Indies. In cast iron machinery France, England, Italy, Austria, Sweden, Switzerland, Japan and Russia were better customers than before; the exports to Spain, Brazil and Chili diminished. The greatest improvement is shown in forge iron machinery for Russia: the quantity exported to that country during the first four months of this year was nearly twice as large as during the same period of 1897. Russia ought to become a great market for American machinery."

It is stated that two concerns represented in New York are quoting upon $500,000 worth of tools for the Russian market, between them.

The Lodge & Shipley Machine Tool Company, Cincinnati, writes us that it is full of orders up to the guards.

### CHICAGO MACHINERY MARKET.

Unlike some other lines, it can be said that the trade in dynamos and motors is at least normal. Some manufacturers say it is more than normal. Whatever the precise degree of activity, there is now considerable business moving week by week. There are also a large number of inquiries on the market, and specifications of various sizes are constantly appearing. They do not represent wholly, or even chiefly, new manufacturing plants. In a majority of cases the installation is being made in old shops, though the percentage of new plants that are thus equipped is not inconsiderable. Trade is better to a marked degree than a year ago, and the hesitation, that came in the spring upon the opening of international hostilities, has largely disappeared so far as electrical work is concerned. The activity which was seen in this line among the new large packing houses constructed in the West last year is now extending to the older plants of the same kind, both at Chicago and elsewhere throughout the West. There are now a number of specifications offered to the trade for their consideration from the packers, with prospects that they will be speedily closed. As a rule the sale of dynamos and motors is more active in the agricultural districts than locally at Chicago, and the prosperity of the farther West, following the splendid crop conditions, is the accredited cause for this relative activity.

The past week has been rather notable for the better inquiry for machinery. The railroads have been conspicuous among the prospective buyers, but from the manufacturing trade generally there has been an improvement. Indications point to quite a brisk fall trade, considerably earlier than usual. The actual business done by the machinery men last week was also better than for some time.

The temper of the iron and steel trades here is distinctively brighter. The change is not marked enough to amount to a revolution, but a continuance along present tendencies for several weeks would mark a decided difference. Business men are anticipating a better trade. They seem fully persuaded that it is coming and coming soon. Whatever may be the outcome of their expectations, the present effect of the improved feeling is to make commerce less sluggish. Heavy contracts in billets and rods are reported, and the local mills are a month or longer behind in their shipments of rails.

For electroplating supplies the market may now be considered active, unusually so for July. The small plants that do job work are not busy, but most of the large manufactories that plate their own work are investing freely in supplies. The stove men are just now among the best buyers, and there is even a little bicycle trade, although it is early for them to order supplies.

The Crocker-Wheeler Company last week sold to the Cudahy Packing Company, of Sioux City, Ia., a dynamo and motor of about 200 kilowatts, and to Deer & Manser, of Moline, Ill., a motor, capacity of about 450 horse-power.

### CINCINNATI'S INCREASE IN TRADE IN 1898.

In pig iron and finished iron and steel the first half of 1898 has witnessed larger sales than the first half of 1897. Rolling mills and forges have been very busy, more so than for some years previous. In machine tools, engines and other machinery the information that has come, from time to time, has been of an encouraging nature all along the line. In order to form a comparison of the first halves of 1898 and 1897 in the machinery market the Cincinnati correspondent of the "American Machinist" has made inquiries of a number of well-known concerns, and offers the following favorable reports. The fact that these names happen to be mentioned does not imply that many others may not be equally busy.

With the Bickford Drill & Tool Company the orders received during the past six months have been the best in the history of the country, and have equalled those of any period of nine months in the two years previous. Foreign trade has been exceedingly good and home trade very encouraging, particularly of late. Prospects for the remainder of the year are decidedly bright.

The Bradford Mill Company finds that its business has kept up well in the last six months, which have shown an increase of some 40 per cent. as compared with the corresponding period last year. A good number of good orders are still coming in. Its export trade is growing all the time and its domestic business has shown improvement over previous years.

Dreses, Mueller & Co. are able to say that their orders up to July 1, 1898, have been 75 per cent. greater in volume than a year ago. They have faith that their business will keep up in a good measure during the remainder of the year.

William E. Gang & Co. can also report an increase of some 75 per cent. in the periods compared. They have now on hand orders to keep them busy for some time to come, and are arranging to enlarge their facilities to accommodate the

increased volume of business. They have had considerable export trade.

Smith & Mills did fully 50 per cent. more business up to July 1, this year, than in a similar portion of 1897. They are still favored with a fair volume of orders coming in.

The J. A. Fay & Egan Company estimates that its half year's trade just closed has equalled the whole of last year's, and they take it to indicate that trade is tending toward a still larger measure of prosperity when the disturbing elements now existing have passed away.

The American Tool Works Company is satisfied that its trade of the past six months has been characterized by a fine increase over the first six months of 1897. They believe that the whole year will show a large improvement over either of the last two years.

Houston, Stanwood & Gamble, in looking over their records for this year, see that, on the whole, the orders received have greatly surpassed in number those of a year before, and they have hope of seeing a continued improvement in demand this year in every particular.

The Sebastian Lathe Company has been very busy so far this year, and, in a general way, estimates its increase in trade over the corresponding portion of 1897 to have been at least 25 per cent.

The Lunkenheimer Company is confident that the increase of its trade for the half years compared amounts to 40 per cent. It could now give employment to fifty more men if it had the room for them, and it is possible that the company will have to enlarge its facilities.

M. L. Andrews & Co. report a gratifying increase in volume of orders for the period under consideration and look forward to a continuance of favorable conditions during the remainder of the year.

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## Quotations.

NEW YORK, Monday, July 25.

Iron—American pig, tidewater delivery:

| | |
|---|---|
| No. 1 foundry, Northern | $11 00 @ 11 25 |
| No. 2 foundry, Northern | 10 50 @ 11 00 |
| No. 2 plain, Northern | 10 00 @ 10 50 |
| Gray forge, Northern | 9 75 @ 10 00 |
| No. 1 foundry, Southern | 10 50 @ 10 75 |
| No. 2 foundry, Southern | 10 00 @ 10 25 |
| No. 3 foundry, Southern | 9 75 @ 10 25 |
| No. 1 soft, Southern | 10 50 @ 10 75 |
| No. 2 soft, Southern | 10 00 @ 10 25 |
| Foundry Forge, Southern | 9 50 @ 9 75 |

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.10 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with some brands perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.50c.

Cold Rolled Steel Shafting—Base sizes, from store, 2.05 @ 2.10c., according to quantity.

Copper—Carload lots: Lake Superior ingot, 11¾c.; electrolytic and casting copper, 11⅛ @ 11¼c.

Pig Lead—Carload lots, 3.95 @ 4.00c., f. o. b., New York.

Pig Tin—For 5 and 10 ton lots, 15.65 @ 15.70c., f. o. b.

Spelter—Carload lots, 4½ @ 4⅝c., New York delivery, according to brand.

Antimony—In cask lots, 8¾ @ 9½c., according to brand.

Lard Oil—Prime city, ice pressed, 49 @ 50c., in wholesale lots.

# Manufacturers.

Peuchen & Co., Toronto, Ont., will add two additional stories to their acid factory.

McKnight & Son, Brown City, Mich., are breaking the ground for their new brick foundry.

Thomas Milien & Co., Wayland, N. Y., are making extensive repairs and additions to their cement factory.

The James Robertson Company, Limited, Toronto, Ont., is adding to their factory to the amount of $2,000.

J. W. Shantz & Son, of Buffalo, N. Y., are reported as being about ready to erect a button factory in La Salle.

F. J. Barber is to build an addition, 40x42 feet, one story high, to his factory on State street, North Adams, Mass.

Kaufmann Brothers', Pittsburg, Pa., new addition is being rapidly built, and will be ready for occupancy in a short time.

The Kent Manufacturing Company, at Clifton Heights, Pa., is about to start the erection of an addition to its plant on Darby Creek.

The Santa Fé people have concluded to expend $200,000 on the plant at Topeka, Kan. A new locomotive erecting shop will be built.

The business of A. J. Johnson & Co., Cleveland, Ohio, will hereafter be conducted by Mr. A. J. Johnson, Mr. W. Kennard having retired.

Estimates are being received for repairs to Cope & Co.'s Tonawanda Mills, at Wayne Junction, Pa., recently damaged by fire, to cost about $5,000.

Owing to the death of Fred Goepper, the firm of Chas. G. Eckstein & Co. has been dissolved, and the business will be continued by Chas. G. Eckstein.

An architect is preparing plans for improvements at Loose Brothers' cracker factory, Second and Main streets, Philadelphia, Pa., which will cost $10,000.

The stockholders of the Cedar Valley Manufacturing Company at Waterloo, Ia., have decided to rebuild their plant, which was recently destroyed by fire.

Work on the foundation was begun recently for the erection of a large addition to the Hanover match factory, York, Pa. The capacity of the factory will be doubled.

The Wellsville Plate & Sheet Iron Company, Wellsville, Ohio, has purchased additional property to the east of their plant and intend erecting new buildings.

The work of remodeling the five-story building to be used by Griggs, Cooper & Co., St. Paul, Minn., as a manufacturing department is well under way, and will soon be in operation. The remodeling of the building and the putting

*Continued on page 38.*

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# Business Specials.

**Gear wheels, gear cutting. Grant; see page 16.**

**Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.**

**Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.**

**Cutters, reamers and small tools, regular and special; vertical millers, cutter and surface grinders, shears and punches. R. M. Clough, Tolland, Conn.**

# Wants.

**Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.**

## Situations Wanted.

Experienced designer automatic and electrical machines. Box 161, AMERICAN MACHINIST.

A mechanical engineer of sixteen years' practical experience, wants position as supt. of machine shop; best references. Address Box 155, AM. MACHINIST.

Position as draftsman by a young man with five years' shop experience. Box 150, AM. MACHINIST.

Designing draftsman, with extensive experience on metal working machinery and tools, wants employment; now at Chicago. Box 159, AMERICAN MACHINIST.

Engineer—Good executive and business ability; familiar shop management; costs; long exp., design, manf all kinds elevators; special hyd., elec. mch'y, desires position. Address Box 151, AM. MACHINIST.

Mill engineer, member A. S. M. E., tech. graduate, wants mechanical charge of growing industrial plant in New England; 6 years' exp.; mill work, stm. boilers, fuel and economy; now employed. Box 160, AM. MACH.

Wanted—By a man of 20 years' experience, a position as supt. or foreman in light manufacturing; was for five years master mechanic of Smith & Wesson, contractor of knitting needles and other work; inventor and manufacturer of the Bullard repeating rifle; the best of references given as to character and ability. J. H. Bullard, Springfield, Mass.

## Help Wanted.

Wanted—First-class designer and draftsman on special machinery and sheet metal tools. Address Box 157, AMERICAN MACHINIST.

Wanted—Ten competent all round machinists; only first-class men wanted; experienced in dynamo work preferred. The Bullock Elec. Mfg. Co., Cincinnati, O.

Wanted—Five tool makers, helpers, pat. maker, on locks and light mach'y, tools and produc.; state exp. and ref. Address Universal Lock Co., Woodbine, N. J.

Wanted—Foreman for machine shop of large electrical establishment; one having held similar position before preferred; in answer state experience, wages required, &c. Address Box No. 152, AM. MACHINIST.

Wanted—Experienced forger and blacksmith as foreman of shop; heavy and light work; good position; steady work for right party. Address, giving references and full particulars, P. O. Box 452, Pittsburg, Pa.

Wanted—A large Chicago manufacturer wants a first-class machine shop foreman; one who understands handling men and modern machine shop practice; must be a hustler; no other need apply. Address Box 123, AMERICAN MACHINIST.

Wanted—By a New England manufacturing company first-class draftsmen to design standard machine tools, such as lathes, planers, shapers, screw machines, milling machines, etc., and who know thoroughly the requirements for a first-class product; men who have had both shop and drawing room experience preferred. Address, giving experience in detail, wages expected and references, Box 142, AMERICAN MACHINIST.

# Miscellaneous Wants.

**Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.**

Best Calipers, Levels, etc. E. G. Smith, Columbia, Pa.

Book, Dies & Die Making, $1. J. L. Lucas, Prov., R. I.

Wanted—1 20 foot pit lathe. Address Box 156, AMERICAN MACHINIST.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

For Sale—25 h. p. boiler and 15 h. p. engine; cheap L. I. Publishing Company, Huntington, N. Y.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Die makers, special mach'y and spec'lt'es wanted for manufacture. Bown Mach Works, Battle Creek, Mich.

For Sale—One Merriman bolt cutter, 3-8 in. to 1 1-2 in.; one 1-2 in. to 2 in.—new. The McLagon Foundry Co., New Haven, Conn.

Wanted—Manufacturer to build gas and gasoline engine, of simple design and effective in its work. Box 158, AMERICAN MACHINIST.

The advertising department of the American Machinist has on hand 20,000 draftsm'n's thumb tacks; will send a box of ten to any draftsman in America on request; could use a postage stamp on box, but will send the tacks anyway.

For Sale—On account of death, 15 horse-power engine, 20 horse-power boiler, in good condition; 20 feet of 2-inch line shaft, pulleys, hangers; one granite polishing machine; one drill machine for iron, very cheap. A. Durkes, 652 Lewis street, Union Hill, N. J.

Institutions retiring from business having machine tools, brass or wood working machinery, will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wanted—Agency or to manufacture for England for thoroughly first-class feed water purifier and scale preventer; advertisers have splendid connection among manufacturers. Full particulars to Filter, care of Messrs. C. Mitchell & Co., Red Lion Court, Fleet Street, London, England.

*Continued from page 37.*

in of the necessary machinery will involve an expenditure of about $25,000, and in addition the force of persons employed in the department will be doubled.

The Crotty & Mitchell factory, Weedsport, N. Y., which was burned about two months ago, is to be rebuilt on the old site. A three-story brick structure, 50x150 feet, is to be built.

The Hancock handle factory in Morgan County, W. Va., was destroyed by fire 15th inst. along with nearly all of the stock and machinery, entailing a loss of several thousand dollars.

Michael Magee & Co., contractors, recently took out a permit to build the two-story brick factory, 180.7x51.8 feet, on the north side of Unruh street, east of Tacony road, Tacony, Pa., for Henry Disston & Sons, incorporated.

In the course of a large fire, which occurred in Pittsburg on the 10th inst., the works of the Pittsburg Valve & Machine Company were destroyed. They were working on a contract for projectiles for the Government.

The Kalamazoo (Mich.) Electric Company will enlarge its plant and improve its service. W. A. Foote, who is interested in electric light plants at Battle Creek, Jackson and Albion, has secured the control of the Kalamazoo concern.

The Gardner Manufacturing Company, Baltimore, Md., has been incorporated by Joshua G. Gardner, Andrew G. Steelman, James Russell, Lawrence O. Wright and Edward L. Ward. The company will manufacture gas engines.

Work on the foundations of the Signal Manufacturing Company's building, Rochester, N. Y., is being pushed rapidly forward by Contractor Guethner. There are to be several buildings, the largest 80x38 feet, four stories high.

Tower & Wallace, of New York, are now completing the plans for the buildings for the new paper mill plant of Kimberly, Clark & Co., at the lower Quinnesec Falls, Mich. The mill will be devoted to the manufacture of print paper.

A building permit has been issued to the Winchester Repeating Arms Company to erect a brick building 40x160 feet on Newhall street, New Haven, Conn., at a cost of $17,000. The new building will be used in connection with the arms factory.

The framework is up and carpenters are hurrying to completion the building for Boyd & Buttrum's new machine shops on East Seventh street, Joplin, Mo. Work is also progressing on McKenna's foundry building, which is to be of brick and steel.

The Pittsfield (Mass.) Coal Gas Company has decided to double its gas-making apparatus. The cost will be about $9,000, and the work will be completed by October 15. A new engine will be put in, and the capacity of the new apparatus alone will be 250,000 feet of gas per day.

It is announced that the mills of the Victor Knitting Mills Company, Cohoes, N. Y., which were destroyed by fire in the spring, are to be rebuilt. The firm, it is said, intends to erect a plant which will be much larger than the old one and employ a much larger number of hands.

Southwestern Aurora Standard Light Company has been organized at Portland, Me., for the purpose of manufacturing and dealing in acetylene gas, with $500,000 capital stock. The officers are: President, Lyman H. Adams, of Boston; treasurer, William F. Miller, of Boston.

The Globe Refining Company, whose plant at Louisville, Ky., was recently burned down, will soon rebuild, and in addition to its refinery and soap business will add a big ice factory. A new lot of land, 300x600 feet, has been purchased adjoining the old property, and this will be built upon.

The Peerless Sectional Gear Company has been organized in Kearny, N. J., with a capital stock of $100,000, all paid in. It will manufacture machinery. The incorporators are former Assemblyman Joseph P. Mullin, of Arlington, and James


# The Hendey Machine Co.,

**Torrington, Conn.**

AGENTS FOR THE PACIFIC COAST:
Pacific Tool & Supply Co., San Francisco, Cal.
J. W. Cregar, Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:
Schuchardt & Schutte, Berlin, Vienna, Brussels, Stockholm.
Chas. Churchill & Co., Ltd., London and Birmingham, Eng.
Adolphe Janssens, Paris, France.

# 16 in. x 6 ft. Hendey-Norton Lathe.

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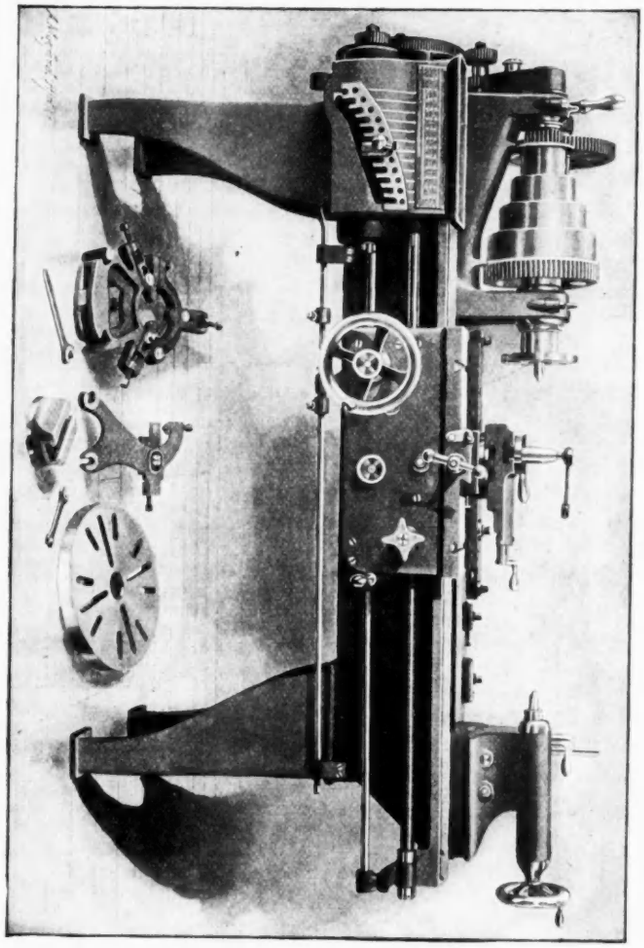
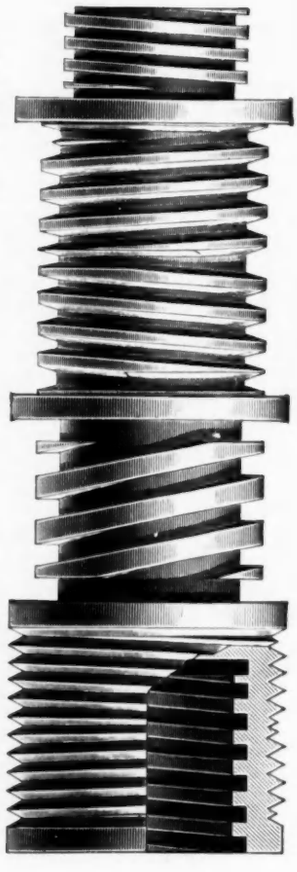


THE HENDEY-NORTON ENGINE LATHE is the most modern type of engine lathe extant. Why? Because it has the best improved attachments known for the rapid and accurate production of high-class lathe work in use on engine lathes at the present time.

One is the Norton arrangement of change gears for screw cutting. All the change gears are mounted in the gear box ready for use. The different pitches are obtained by the simple movement of handle in gear box from one notch to the other, carrying with it an intermediate gear meshing into the cone of change gears. Thus every thread required in ordinary use is obtained on the instant, and this applies equally well to the feeds.

Another is the reversing lever at side of apron. At the moment of changing travel of carriage, as when cutting threads, you have but to move up or down this lever when the *carriage*—not the countershaft, belt, head spindle and work—returns in the opposite direction, and so on till work is finished. This saves wear and tear on working parts.



In this specimen of thread cutting we have a good illustration of the application of the above features; but it is here shown to illustrate in particular what our Automatic Stop will do. It shows how threads can be cut to and from shoulders, both internally and externally, tool stopping to a certainty, and with work in motion. This feature is equally applicable in turning work in duplicate. The Automatic Stop is at once positive and simple.

The CROSS OIL FILTER

actually reduces oil bills 50% or more. Sent on approval. Capacities 3 to 120 gals. per day. Used in 18 countries. Testimonials from the leading firms in every field of industry.

THE BURT MFG. CO.
AKRON, OHIO, U. S. A.

Business Established 8 Years.

Largest Manufacturers of Oil Filters in the World.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.

Lathes.

LODGE & SHIPLEY MACHINE TOOL CO.,
Cincinnati, Ohio.

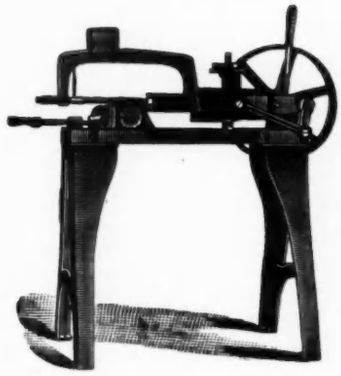
The Walker Cutter and Reamer Grinder.

The illustration shows this grinder arranged for cutter and reamer grinding only, and is designed to fill the demand for a machine not so elaborate as a complete grinder, but so arranged that the different attachments which are interchangeable can be added when desired.

Norton Emery Wheel Co.,
Worcester, Mass.

"The best is as good as any."

The New Automatic and Gravity Feed Q & C Shop Saw

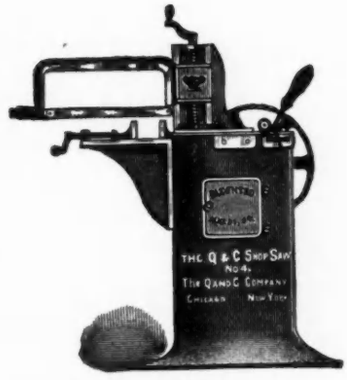


Cuts { Tool Steel, Machinery Steel, Iron, Brass and All Other Metals.

Price—'Way Down.
Quality—'Way Up.

Shop Saws,
Portable Rail Saws,
Cold Power Saws,

For All Purposes.




Send for Catalogue.

Q & C Company,

Chicago. New York.

LONDON: Chas. Churchill & Co.
PARIS: Hounsfield & Fils.
BERLIN: Schuchardt & Schutte.
MADRID: J. G. Neville & Co.


H. Fogarty and Emile J. Meterle, of East Orange. The company will use all of Mr. Mullin's patents.

Plans and specifications have been completed by the Humbert Tin Plate Company for the enlargement of the plant at South Connellsville, Pa., from a four-mill to a six-mill, and probably a seven-mill plant. An addition of 50 feet will be built to the present building, and about $50,000 will be expended for machinery and buildings.

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## New Catalogs.

We are in receipt of a catalog of machine tools, sold by Patterson, Gottfried & Hunter, of 150 Centre street, New York, 32 standard size pages.

The Stephenson Manufacturing Company, of Albany, N. Y., has sent us catalog of belt dressing, boiler compound, etc. A number of letters from users of these specialties is included, and the catalog is standard size, 3½x6 inches.

The Bristol Company, Waterbury, Conn., has forwarded to us copy of its latest revised "partial list" of recording instruments for pressure and temperature. A copy of this list will be forwarded to those interested upon application.

We have received from the W. F. & John Barnes Company, Rockford, Ill., catalog of upright drills, lathes, drill chucks, grinding and polishing machines and other metal working machinery. The catalog is standard size, 6x9 inches.

We have received from the Diamond Rubber Company, Akron, two catalogs, one devoted to pipes, couplings, bands, reels, etc., and the other to belting, hose, packing and various other kinds of mechanical rubber goods. The catalogs are 4½x6½ inches.

We have received from the Brown & Sharpe Manufacturing Company, Providence, R. I., catalog of standard gages, comprising caliper, internal and external cylindrical, and limit gages, also measuring rods. The catalog is standard size, 3½x6 inches.

We have recently received catalog of motors from the American Motor Company, New York city. These motors are capable of being operated by kerosene, gasoline, or natural gas, and are especially adapted to marine propulsion. The catalog is 6x9½ inches.

We have received from the Winton Motor Carriage Company, Cleveland, Ohio, catalog illustrating and describing the Winton motor carriage, which is driven by a gasoline motor. A detailed account of the various parts is given, and the catalog is 5¼x7 inches.

We have received from the Illinois Steel Company, Chicago, Ill., a pamphlet in which a description of each of the various plants operated by this company appears. Views of these different works accompany the description. The pamphlet is 5½x7 inches.

We have received from the Chas. F. Elmes Engineering Works, Chicago, catalog which is devoted more especially to views of the various departments of the plant. This firm manufactures hydraulic machinery, feed water heaters, yacht engines, etc. The catalog is 7x9½ inches.

W. W. Oliver, Buffalo, N. Y., has sent us catalog No. 12 of machine tools used by jewelers, dentists, amateurs, etc., such as rolling mills, jewelers' milling machines, drills and other tools used by those in the trades referred to. The catalog is standard size, 6x9 inches.

We have received from the Standard Tool Company, Cleveland, Ohio, catalog of twist drills, chucks, taps, milling cutters, etc. In addition to descriptions of tools a quantity of useful information is included, tables of decimal equivalents, speed of drills, etc. The catalog is 2¾x5¼ inches.

"Lightning Arresters" is the title of a short treatise issued from the press of the General

Electric Company, in which is described devices for preventing injury to electrical apparatus by lightning. It is tastefully gotten up and will be sent to those interested by addressing the company at Schenectady, N. Y.

We have received from B. F. Sturtevant Company, Boston, Mass., catalogue No. 96 of steel plate fans to be driven by steam, pulleys and electricity. Together with description of the various styles of fans shown, instruments for testing are shown and a number of useful tables are given. The catalog is 6½x9 inches.

The Goheen Manufacturing Company, of Canton, Ohio, has sent us a catalog entitled "Experience, Not Experiment," and in which is described carbonizing coating, a composition used in coating iron and steel structures and which preserves them from rust and corrosion. The catalog is standard size, 6x9 inches.

We have received from the Deming Company, Salem, Ohio, copy of catalog containing illustrations and descriptions of a variety of pumps for house and mine service, also air compressors. Some very useful tables are given, relating to the friction of water in pipes, water pressures, etc. The catalog is standard size, 6x9 inches.

We have received from Wm. O. Webber, Boston, Mass., a pamphlet setting forth some of the reasons why power users, power buyers and sellers should employ means of arriving at an accurate knowledge of power developed, purchased or supplied. The pamphlet is illustrated and will be sent to anyone interested on application.

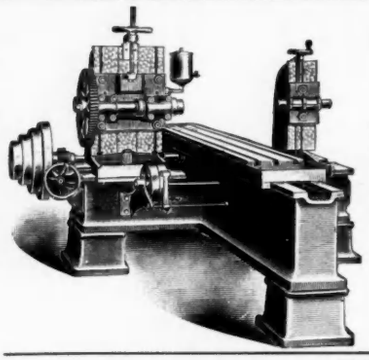
We have received from the Ingersoll-Sergeant Drill Company, New York, a copy of a condensed edition of their air compressor catalog. Illustrations of various types of compressors are given, together with testimonial letters from users of the same. Copies of this catalog will be sent to those interested on application. It is 3½x5¼ inches.

Thomas G. Oakes & Co., of No. 54 John street, New York, send us their catalog and price list for 1898-99. It gives sizes and prices of "Oakes' Acorn" valves of all kinds, from ⅛ inch upward, and prices on Oakes' disks for high and low pressure and "Oakes' Acorn Jointing" and "Royal Red Packing." It will be sent to anyone interested upon application, post paid. 3½x6½ inches.

We have received copy of 1898 catalog from the Lunkenheimer Company, Cincinnati, Ohio, describing a large variety of brass and iron valves, cocks, injectors, lubricators, etc. The catalog contains 208 pages, and toward the end some tables are given which should prove of interest to mechanics. The catalog is 5x7 inches, and will be mailed to those interested upon application.

Steel gears and pinions form the subject of a small pamphlet issued from the press of the General Electric Company, Schenectady, N. Y., under the title "A Modern Gear Plant." It contains a description of the plant which that company has established at the River Works at Lynn, for the manufacture of steel gears and pinions. This pamphlet, which is 4¼x6¾ inches, will be sent on application.

Fenwick Fréres & Co., 21 Rue Martel, Paris, send us their catalogs—one of machine tools and one of small tools—"Catalogue de Machines-Outils Americaines" and "Catalogue Petit Outillage Americain." Though these catalogs illustrate and describe American tools exclusively, they themselves are French. That is to say, they are not mere translations of the American catalogs of the builders, but are rewritten in French by our friend, M. Mandon, and are adapted to French conditions. Tools of Brown & Sharpe Manufacturing Company, Pratt & Whitney Company, Bement, Miles & Co., Gisholt Machine Company, F. E. Reed Company, W. F. & John Barnes Company, Gleason Tool Company, E. Horton & Son Company, T. & B. Tool Company and the Norton Emery Wheel Company are shown. We note with feelings of gratification that special attention is paid to centering tools, and the evils of improperly made centers are shown, along with the tools for making them properly.

**Power Milling Machines**

1894 MODEL.

Made in two sizes with *single head*, with foot-stock as shown in cut or without it, with *overhanging arm*, also with *two heads*. The *Tables* are driven by a large, powerful worm engaging with a rack screwed to table, and have automatic adjustable stop motion, also *patent adjustable stop mechanism* which allows the work to be run up to the cutters without breaking the teeth. Machines, of similar style, made in two larger sizes, with table feed in either direction of travel. Ask for the "Machinists'" Catalogue.

THE PRATT & WHITNEY COMPANY,
HARTFORD, CONN., U. S. A.
New York: 123 Liberty St. Boston: 144 Pearl St.
Chicago: 42 South Clinton St.
London, Eng.: Buck & Hickman, 280 Whitechapel Road.
Paris, France, Fenwick Freres & Co., 21 Rue Martel.

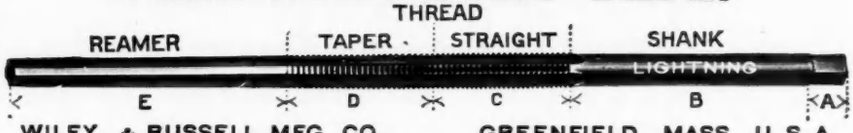
**ENGINE and SPEED LATHES**

IN VARIOUS LENGTHS—9 to 15 in. SWING.
Latest and Most Approved Designs. Workmanship, Material and Finish of the Highest Order.

SEBASTIAN LATHE COMPANY,
117 and 119 Culvert Street, CINCINNATI, OHIO, U. S. A.
Agents: SELIG, SONNENTHAL & CO., London, Eng.; JOHN TRAGARDH & CO., Goteborg, Sweden; E. SONNENTHAL, JR., Berlin, Germany; R. S STOKVIS & ZONEN, Rotterdam, Holland.

**Slide-Valves.** A book for practical men on the Principles and Methods of Design; with an Explanation of the Principles of Shaft Governors. By C. W. MACCORD, Jr., M. E. First Edition. First thousand. 8vo. Cloth. 168 pages and 101 illustrations. $2.00.
JOHN WILEY & SONS, New York City.

**FINE STAY-BOLT TAPS.**

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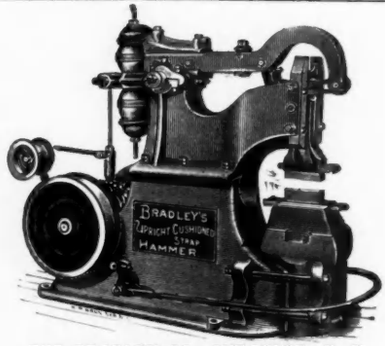


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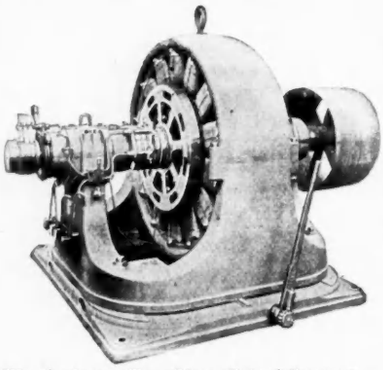

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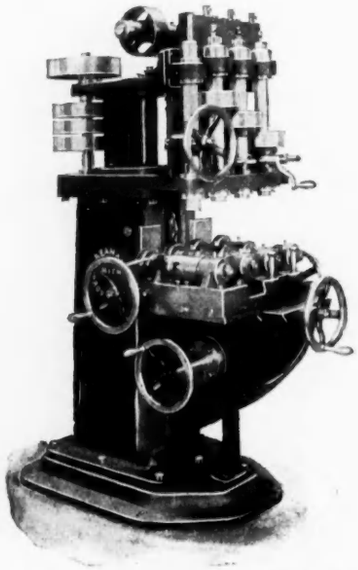

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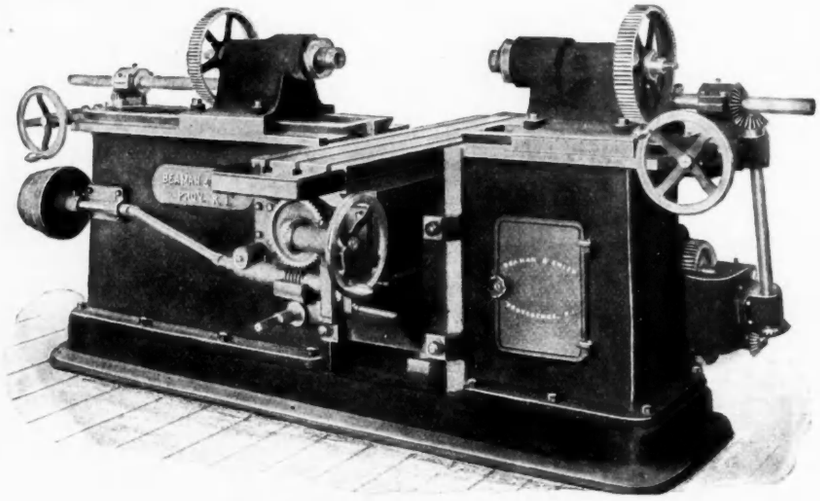

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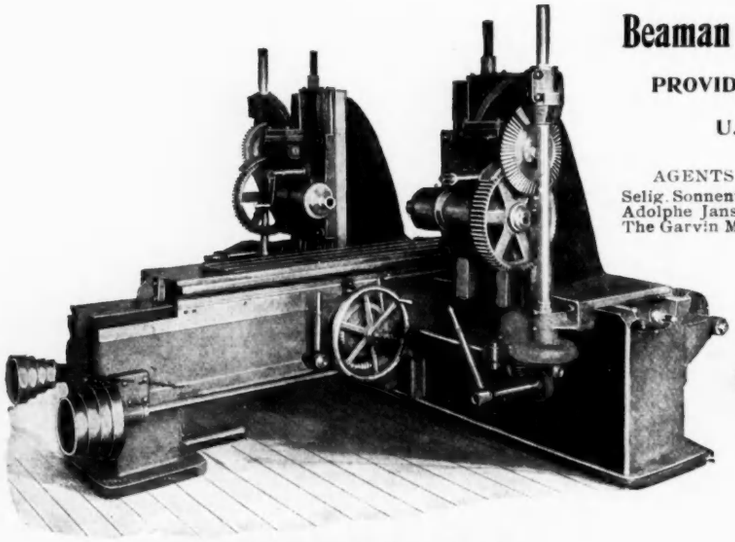

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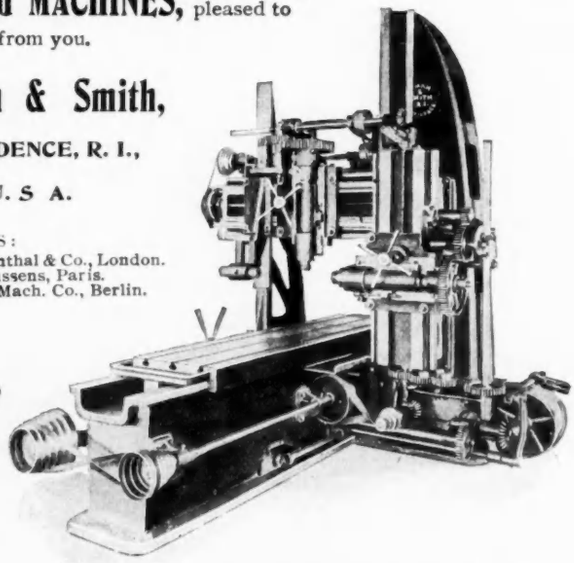

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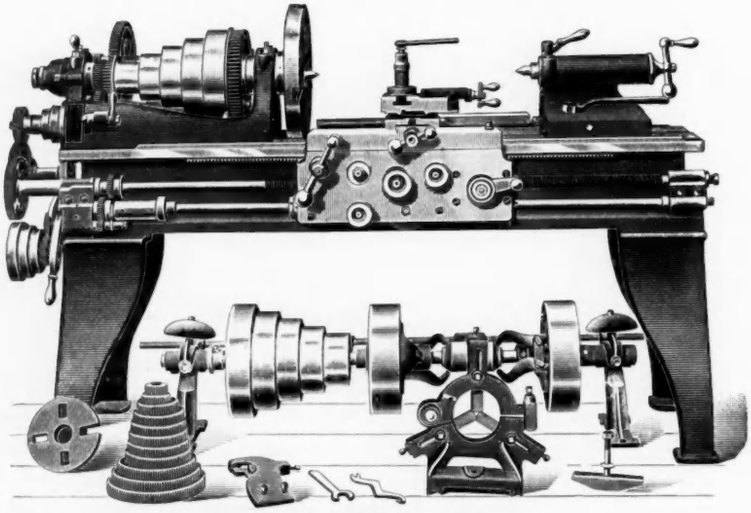

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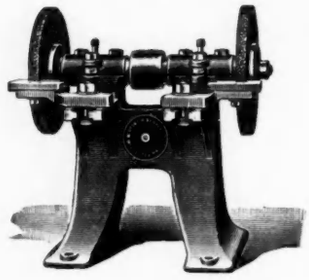

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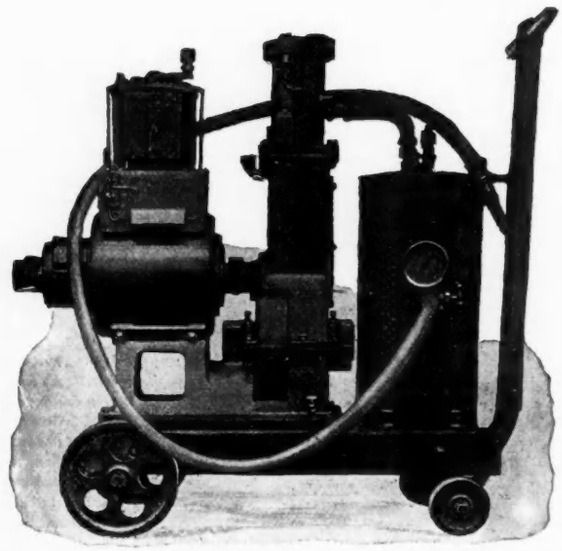

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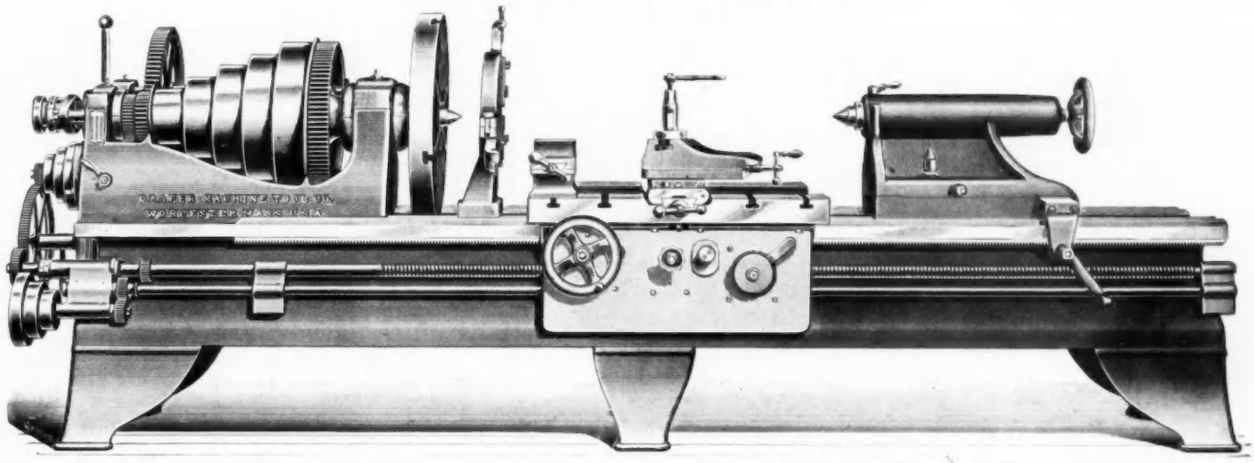

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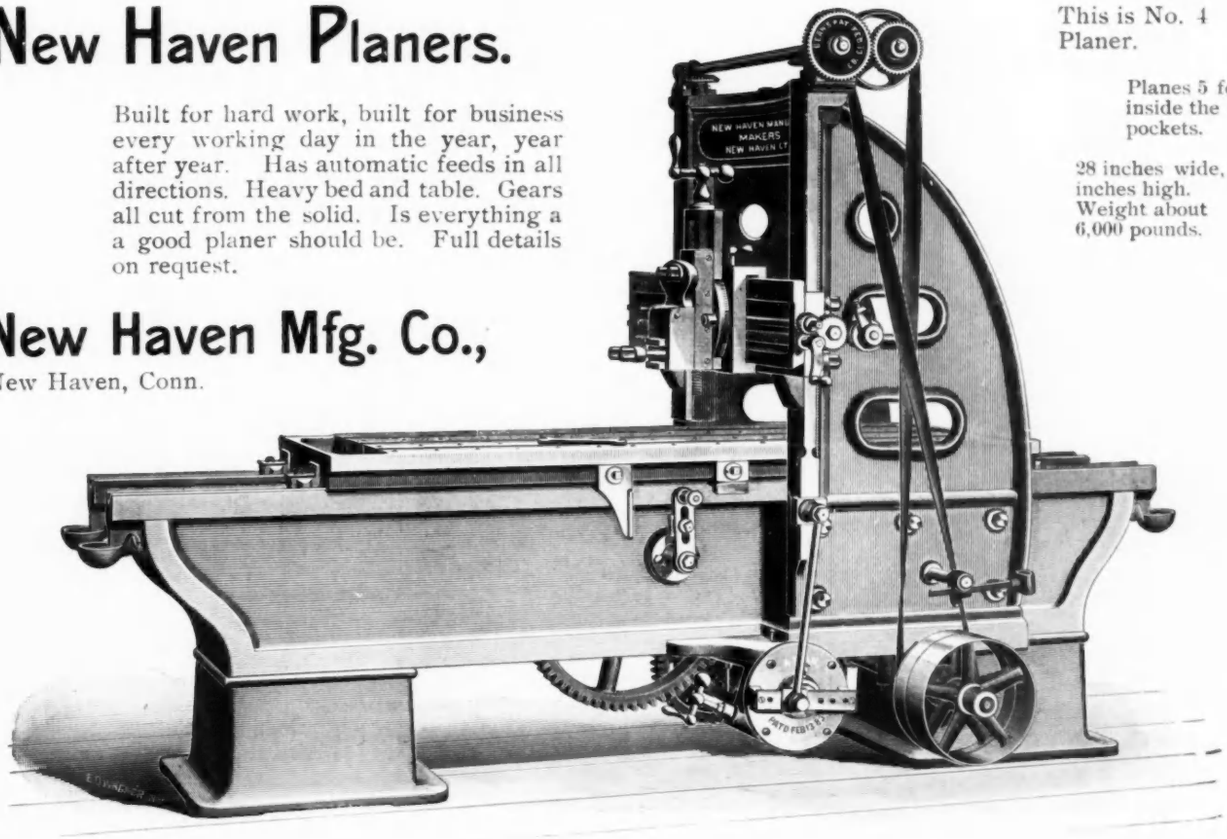

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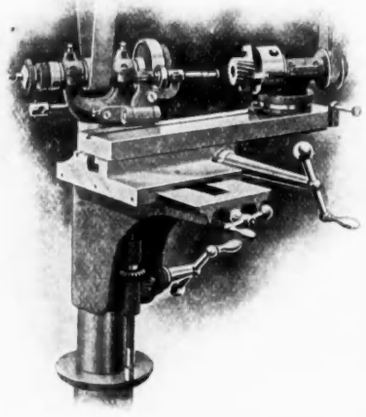

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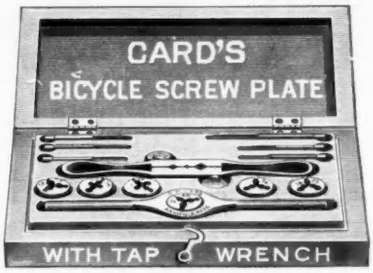


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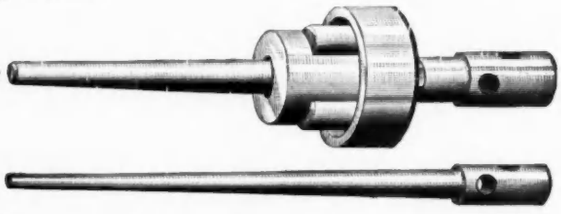

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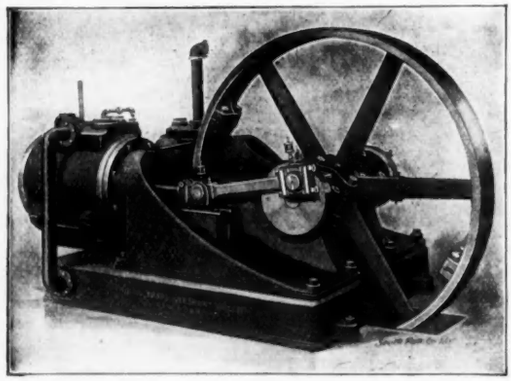

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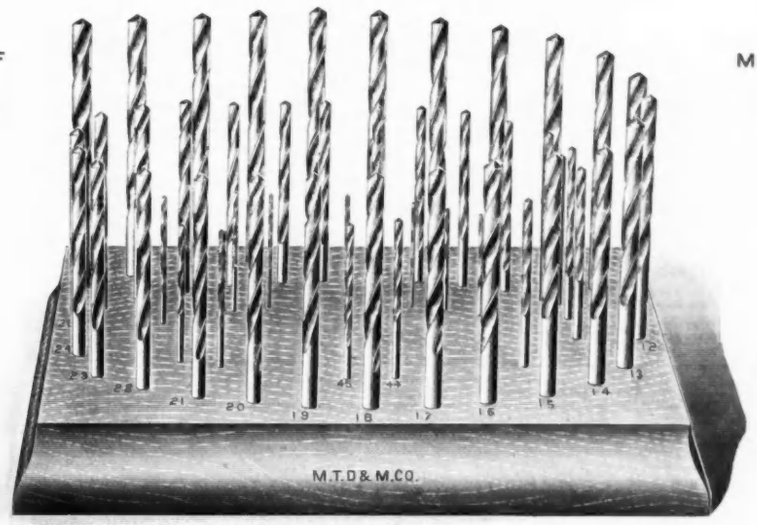


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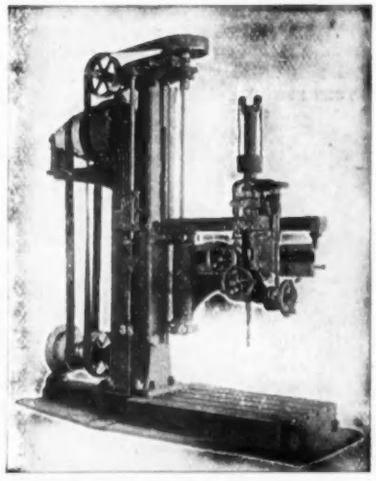

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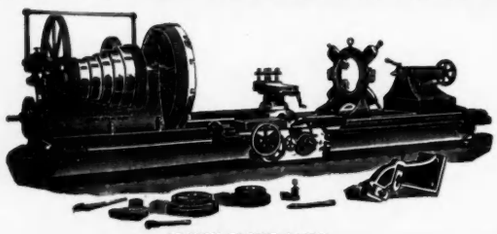

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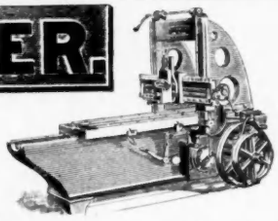

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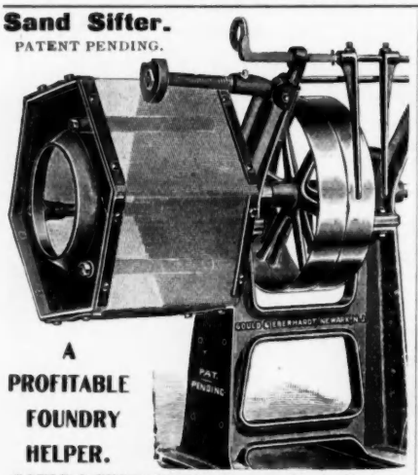


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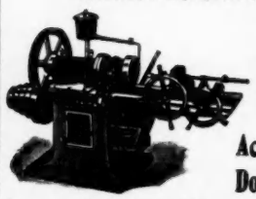

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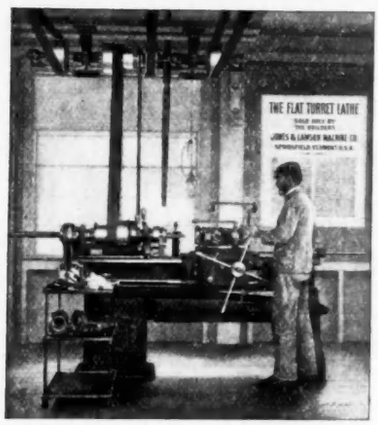


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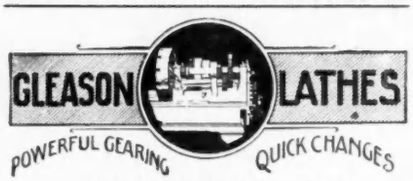


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